DIESEL AND GAS ENGINE PROGRESS

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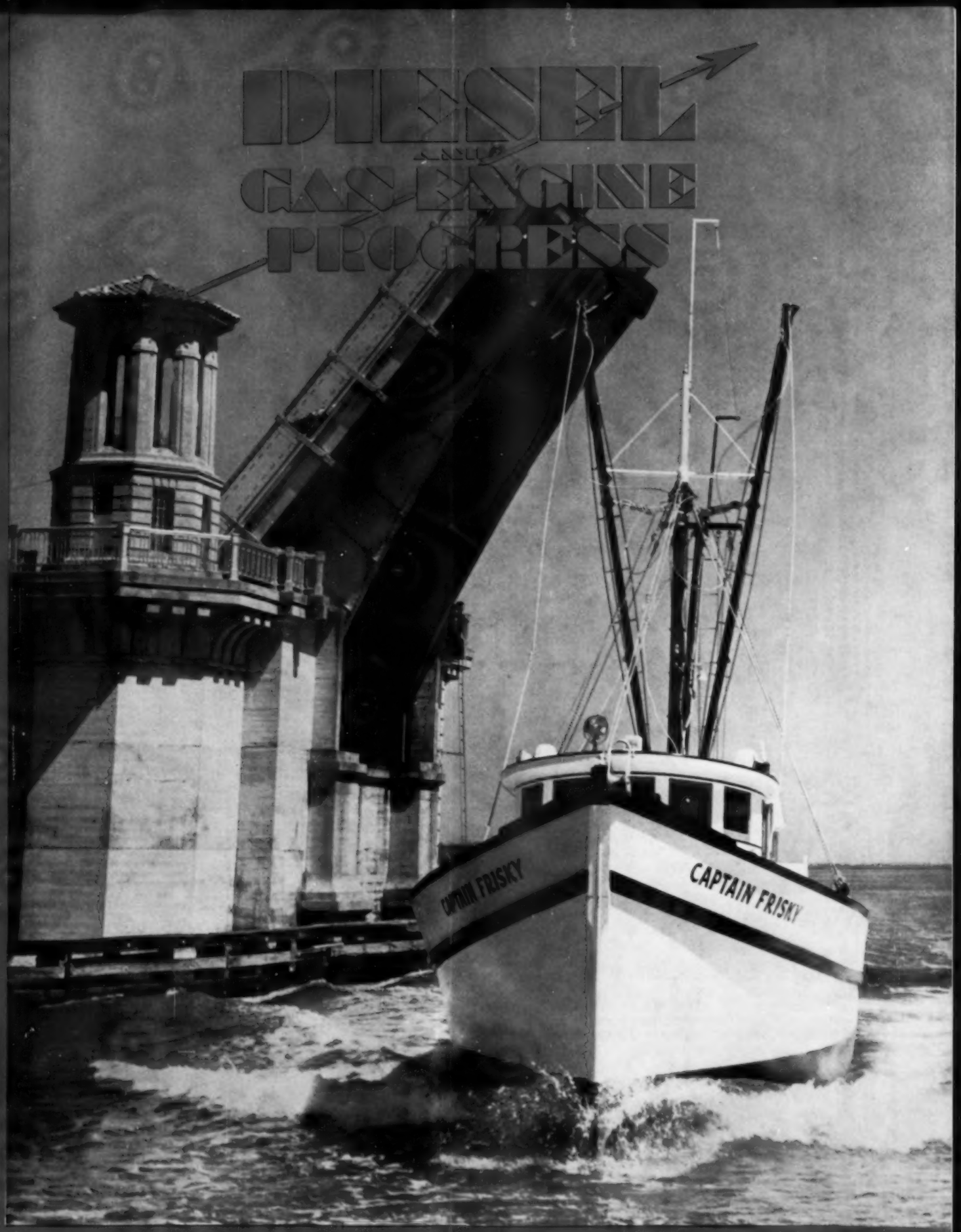

VOL 2 8

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TEXACO DIESEL DATA

HOW TO SPOT FUEL INJECTOR PROBLEMS

The fuel injector is a most important and complex part of a diesel engine. The effects of a badly adjusted fuel injector can run all the way from increased fuel and lubricant consumption to ring and bearing failures.

Here are some of the characteristic symptoms you'll get if your fuel injector is acting up, and what the most likely cause of each symptom is.

1. **Symptom:** Heavy black smoke at exhaust; loss of power; rough idling.
Probable Cause: Incomplete combustion, due to worn injector nozzle.

2. **Symptom:** Rough, noisy engine; stuck or broken rings; bearing failure in most severe instances.
Probable Cause: Pre-ignition, resulting from premature fuel injection. Causes extreme high temperatures and pressures in combustion chamber.

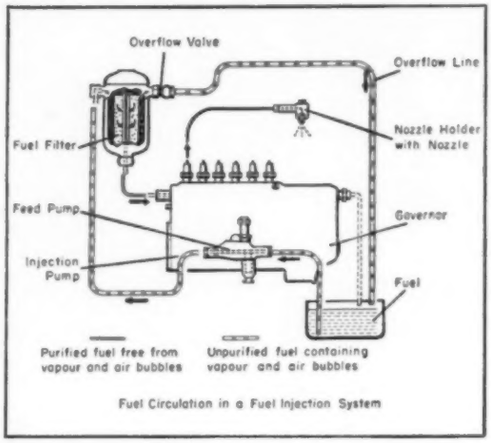
3. **Symptom:** Smoky exhaust; heavy soot deposits in engine and crankcase oil.
Probable Cause: Incomplete combustion due to late injection.

4. **Symptom:** Premature ring wear in some cylinders, heavy varnish formation in other cylinders; engine sounds uneven under load; white or light-blue smoke when engine is idling; dilution of lube oil.
Probable Cause: Improperly equalized injectors, which pump too much fuel into certain cylinders, starve others. "Over-fed" cylinders do most of the work.

Some of these symptoms can be cured with a comparatively minor adjustment; others require more involved techniques.

Improperly equalized injectors, especially on large engines, can be double-checked by a speed-drop test. This involves cutting out one cylinder at a time while you're checking the engine speed with a tachometer. The speed will fall off the most when you cut out the cylinders that are getting the most fuel.

Some folks try to get more power out of an engine by injecting more fuel than the engine was designed to take. You do get more power this way, but it's at the expense of your rings and bearings, and the exhaust becomes excessively smoky. The following chart shows the increase of ring temperature and exhaust smoke on a 4-cycle diesel experimentally overloaded with fuel:



Fuel Circulation in a Fuel Injection System

Fuel/Air ratio	% rated load	BMEP	% exhaust smoke*	Ring groove temperature
.03	67	51	7	336
.04	100	76	7	372
.05	112	85	16	396
.06	114	87	69	402
.07	113	86	92	397
.08	111	84	97	388

*Smokemeter reading.

Because a fuel injector is as carefully built as a good watch, it's best to let your manufacturer's service organization help you out with maintenance and repair problems. The most valuable type of preventive maintenance the diesel operator can do is to keep the injector clean. That means no disassembling of the unit in a dusty or otherwise contaminated atmosphere. It also means that you must use nothing but *clean* fuel. Contaminated fuel can ruin a fuel injector nozzle within a few days. You have to be particularly cautious if your injector isn't equipped with a dependable fuel filter. Water in the fuel is objectionable too, not only because it gives uneven engine operation but because it promotes corrosion of valve parts.

Fuel injector problems are best handled by trained experts. The same is true of diesel fuel and lubrication problems. Texaco has many, many years' experience in fueling and lubricating diesel engines of all sizes, in all types of operations. If you're having a problem with diesel fuel or lubricants, contact Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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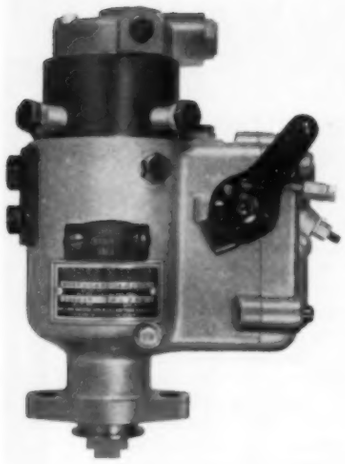

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FRONT COVER ILLUSTRATION

Captain Frisky, powered by Cat D342C diesel, is 900th vessel built by Diesel Engine Sales Co., of St. Augustine. For story see page 41.

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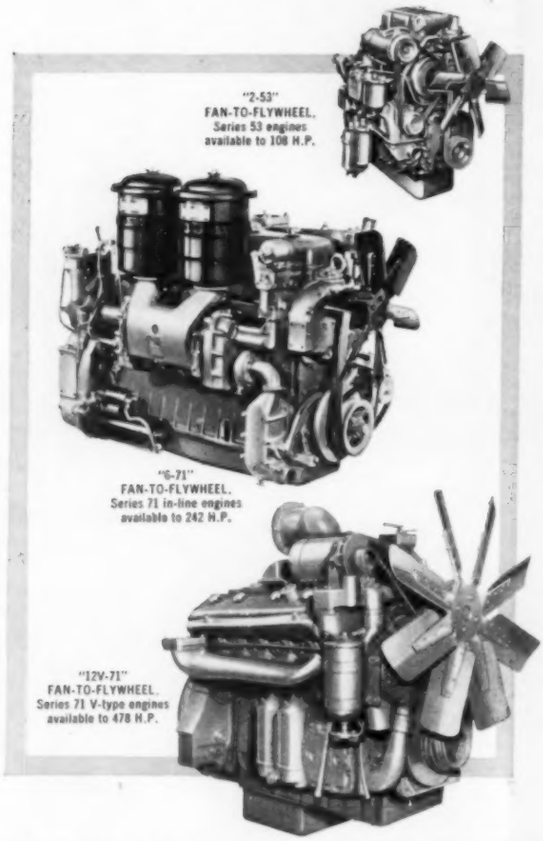

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For complete specifications, write to Government Sales Section, Detroit Diesel Engine Division, 13400 W. Outer Drive, Detroit 28, Michigan, or contact Washington office, 801 Cafritz Bldg., 1625 Eye Street N.W., Washington 6, D.C.

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Four ruined diesels prompt quick switch to Purolator 2-stage dry-type filters with built-in double protection.

"A lot of abrasive silica dust passed right through our old single-element filters and completely ruined four drilling-rig diesels," reports Emil McConnel, New Jersey Drilling Co. VP.

"The extra protection offered by a second filter element sold us on the idea of switching to Purolator 2-stage air filters. Performance has been completely satisfactory. These filters now protect all our motive equipment."

Why Purolator 2-stage filters give complete protection.

Purolator's 2-stage air filters offer extremely high performance because they contain two Micronic® filter elements — each operating independently. If one element should get out of order, the other keeps on removing 99.98% of all contaminates. Harmful abrasives never get into the engine—no matter how dirty the job.

Easy, quick maintenance.

Servicing the 2-stage filter takes only minutes. After housing cover is removed, used element is lifted out and replaced with a new one. First-stage element lasts up to 2,000 hours. Second-stage element should last almost indefinitely.

For complete details on the 2-stage, dry-type air filter, write: Purolator Products, Inc., Dept. 7137, Rahway, N. J.

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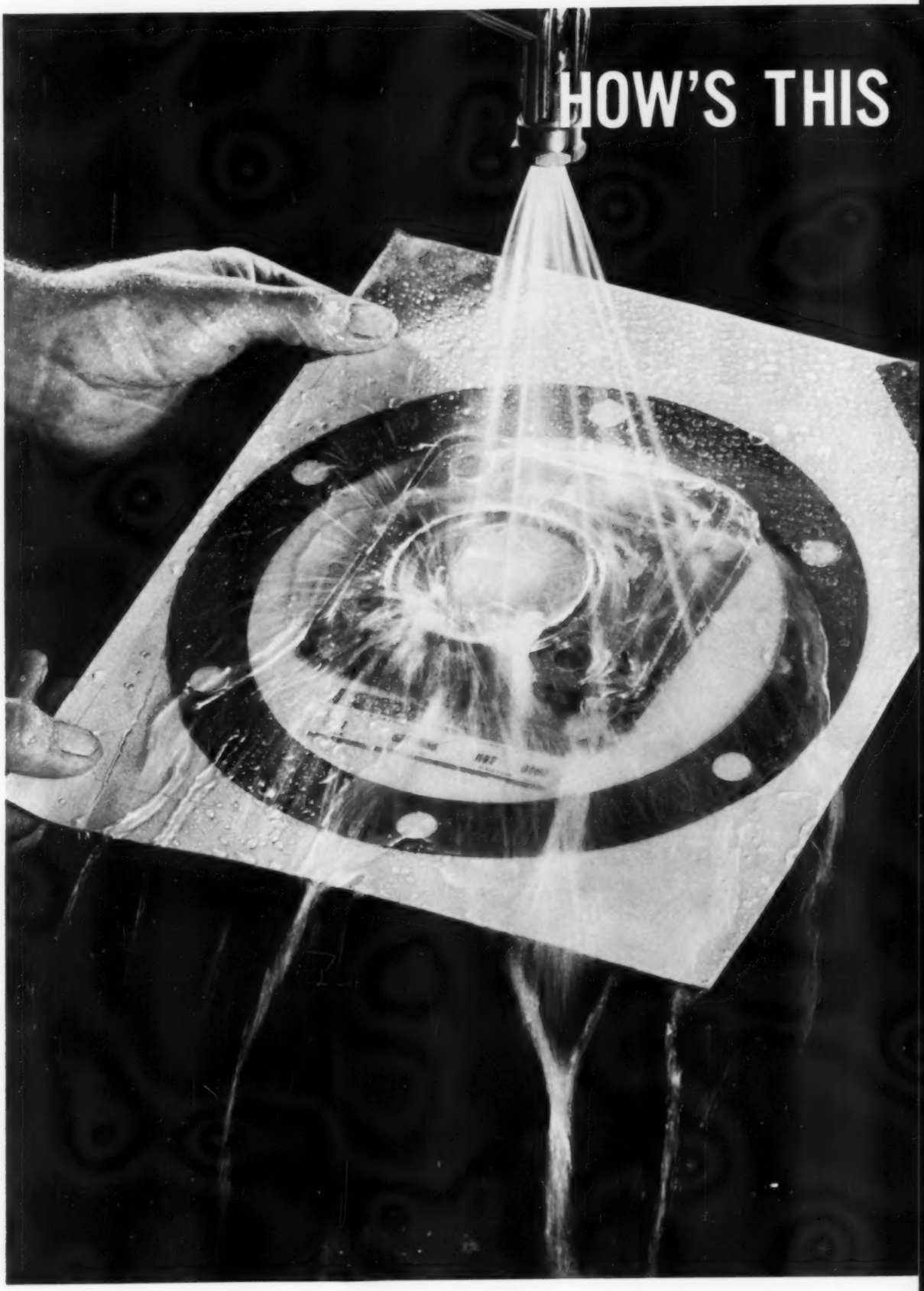
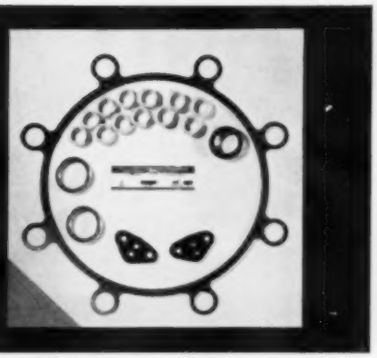

HOW'S THIS

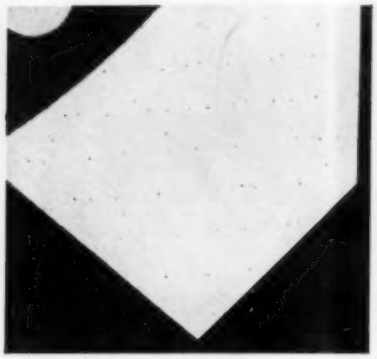
FOR PROTECTIVE PACKAGING?

See the benefits of Electro-Motive's exclusive skin packaging of replacement parts.



Immediate visual identification

No need to open boxes, spill contents. Set of replacement gaskets shown here can be positively identified without being opened.

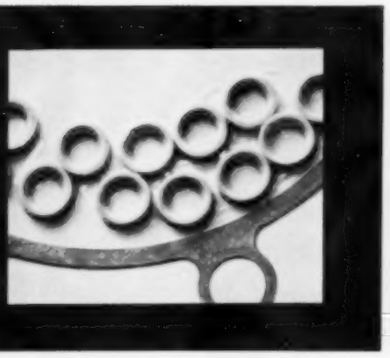


Positive seal keeps contents fresh

Tiny holes in the special backing material permit all air to be withdrawn from package. Holes are closed when vacuum is released, forming a tight seal. Gaskets retain natural moisture—won't dry out or shrink even when stored for a year or more.

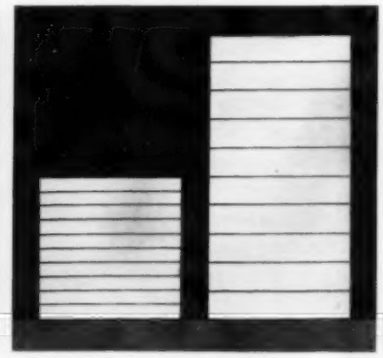
Moisture, vapor can't get in

The same protection that keeps natural moisture in keeps undesirable moisture—as well as dust and dirt—out. Dampness, high humidity or accidental soaking cannot damage the contents.



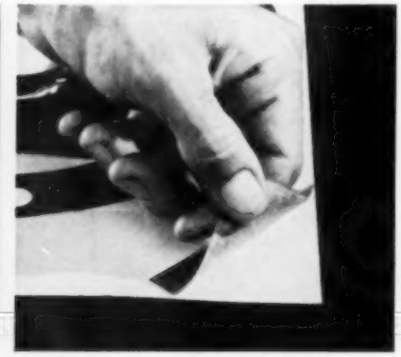
Parts held firmly, protected from damage

Close-up view above shows how skin-tight packaging holds each part firmly in place. There is no chance for loose parts to rattle around and become damaged or misshapen during shipment and normal handling.



Reduces storage cube requirements

The skin-tight packaging reduces all parts to minimum cube. No extra, unnecessary carton bulk to rob you of costly storage space. Forty sets of skin packaged gaskets will fit in the same cube normally required by twenty.



Easier to open than a pack of cigarettes

To open the skin-packaged parts, simply grasp the tab at the corner where skin does not adhere to backing material. Pull the skin away from the backing material. The parts are ready for instant use.

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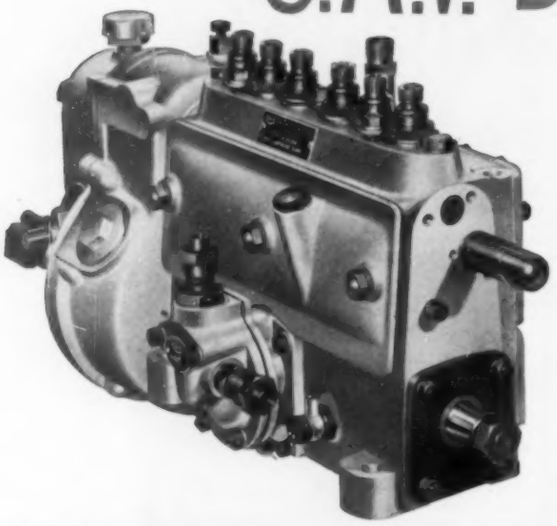

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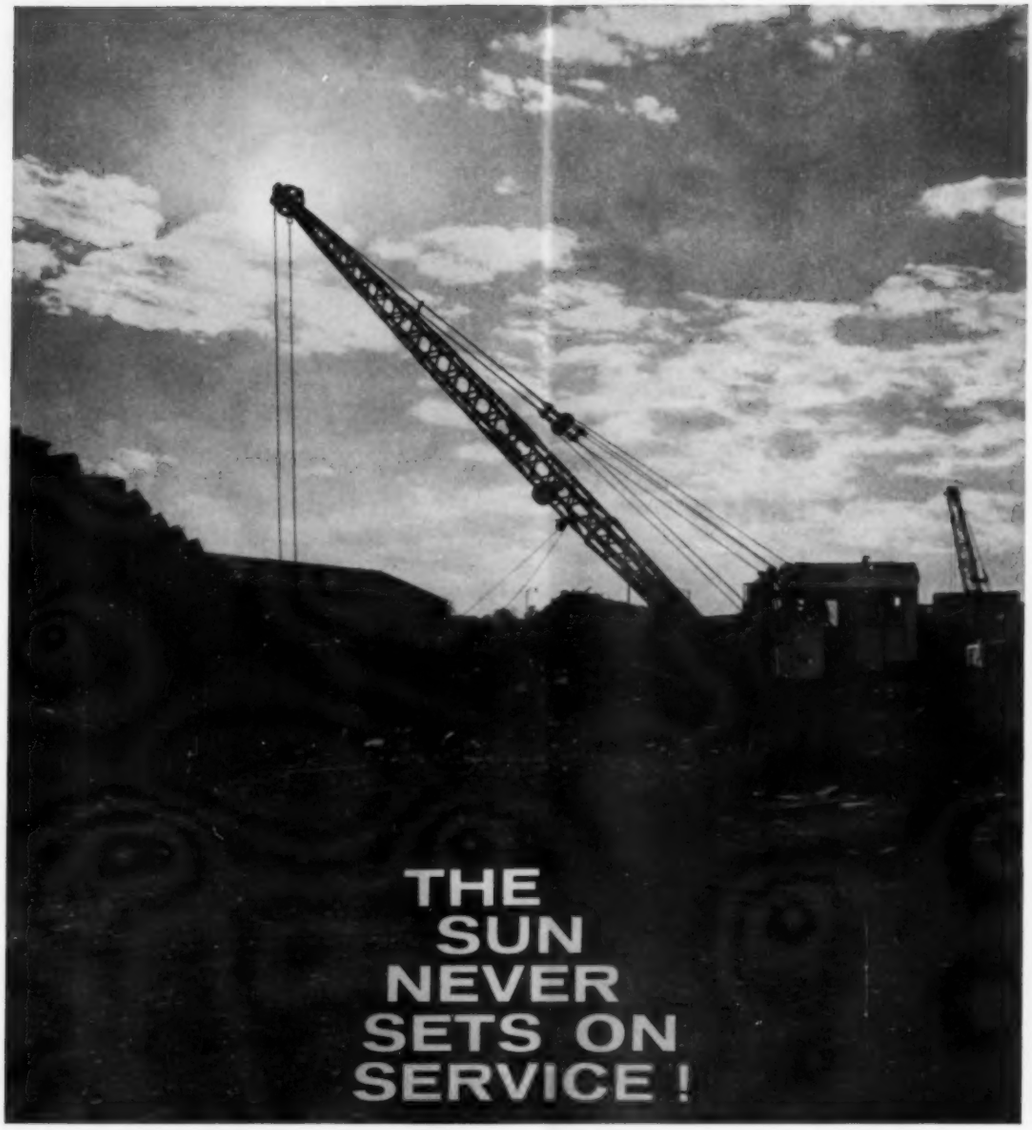

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COOPER-BESSEMER'S NEW HIGH OUTPUT VEE-TYPE ENGINE

Compact New 12 and 16 Cylinder Turbocharged V-Type Engine for Stationary and Marine Drive Applications Available in 2960 to 4275 Horsepower Range and Rated at 175 BMEP

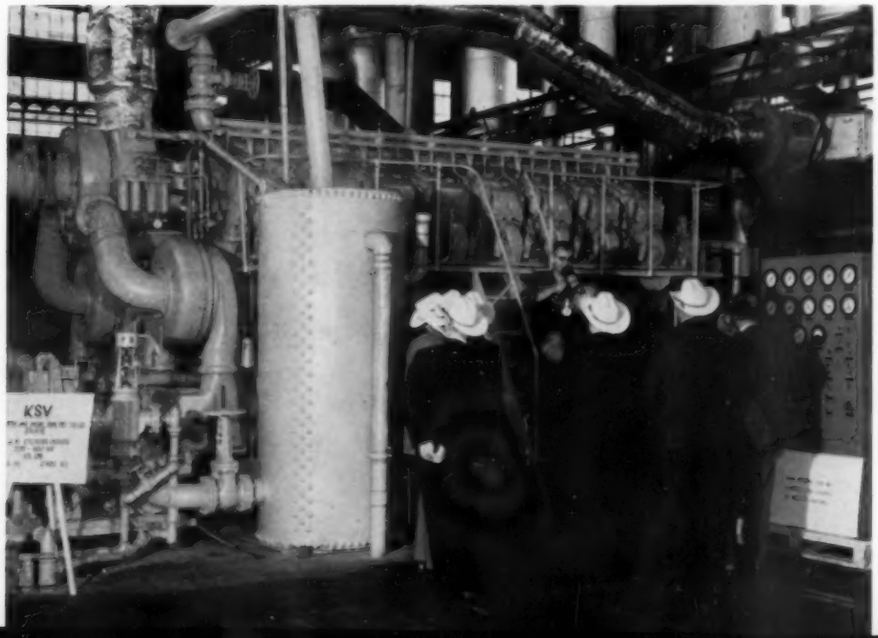
MOUNT Vernon, Ohio—A completely new, turbocharged V-type four-cycle engine designated the KSV has been added to the Cooper-Bessemer product line. The engine, witnessed under full load test by your editors at the company's Grove City, Pa. plant, is designed for continuous heavy-duty service in pipeline pumping and compressor operation, marine propulsion, electric power generation and other stationary drive applications. Introduction of the KSV is very important. Not only does it represent a very compact and efficient power unit, as we shall see, but it characterizes the very dynamic pace being set by the larger engine builders to provide users with high output power packages designed to meet modern operating requirements and economic conditions.

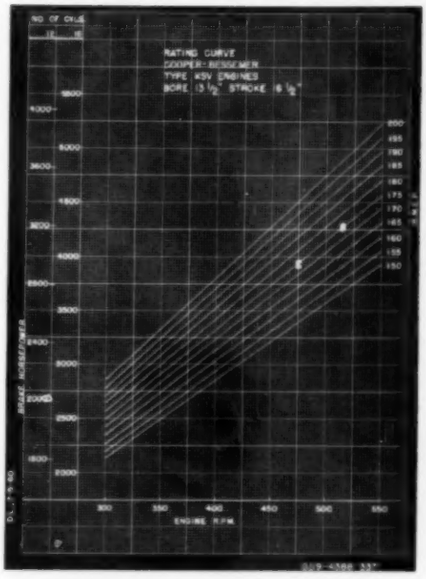
The KSV has a 45° Vee angle and is built in two configurations—both 12 and 16 cylinder. A trifuel unit, the engine is capable of operation as a full diesel, with spark-ignition natural gas, or as a gas-diesel using pilot injection of solid fuel oil for ignition purposes. A Cooper-Bessemer ET-18 turbocharger with a pressure ratio of approx. 2.7:1 is mounted off the forward end of the engine and is integrally piped with the engine for lube oil and water provision. On the spark-ignited gas engine and gas-diesel version, two Cooper-Bessemer model AT18 turbocoolers are used. These engines are also equipped with the company's balanced air-fuel ratio controls whose function is to maintain a precise and accurate air-fuel ratio throughout the load and speed range of the engine.

Special attention in the design of the KSV was given to minimum maintenance, easy service accessibility and compactness. The latter is achieved by means of an underhung crankshaft, articulated connecting rods and short power piston design. Underhung construction permits a stroke bore ratio of only 1.22 and the short piston length is 131 per cent of the bore diameter. General design parameters give the KSV a 13½ in. bore, 16½ in. stroke with a piston displacement per cylinder of 2360 cu. in. Compression ratio is 11.6:1, and compression pressure at 475 rpm is 555 psi. Piston speed is 275 ft./min./100 rpm.

As can be seen in the following performance chart, both cylinder models have an operating speed range of 475–514 rpm. At the rated 175 Bmep and 514 rpm, the 12 cylinder engine has a maximum continuous output of 3200 hp, and the 16 cylinder—4275 hp.

New KSV engine on the test floor of Cooper-Bessemer's Grove City plant during the recent Power and Compression Roundup.





Performance Chart

		BMEP	BSFC
Spark gas engine, 475 rpm		125	6600
		150	6325
	Rated	175	6200
Spark gas engine, 514 rpm		125	6650
		150	6375
	Rated	175	6225
Diesel engine, 475 rpm		125	.365
		150	.362
	Rated	175	.361
Diesel engine, 514 rpm		125	.367
		150	.366
	Rated	175	.365
Gas-diesel engine, 475 rpm		125	6510
		150	6375
	Rated	175	6325
Gas-diesel engine, 514 rpm		125	6650
		150	6600
	Rated	175	6620

There are several unusual design features in the new KSV such as velocity cooled cylinder liners with a special cylinder-to-block gasket arrange-

ment. We will look at this design and others as we cover the various components and systems.

Base—Base is a large one-piece Meehanite casting upon which the main centerframe of the engine is supported. The base serves as an oil reservoir and it is also equipped with large access doors to provide maintenance access to the base cavity. Main suction oil and pressure oil headers are located in the base.

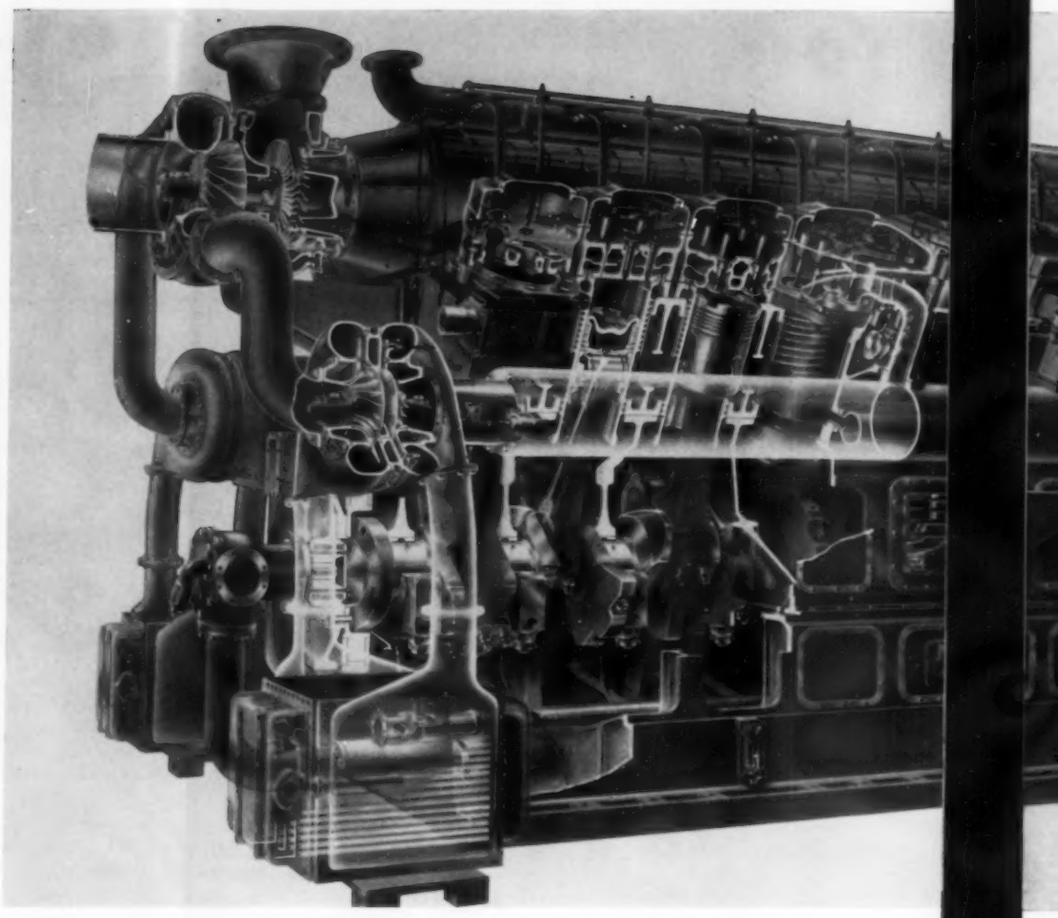
Centerframe—Centerframe of the engine mounts upon the base and is machined at 22½° angle from the vertical centerline of the engine to support main cylinder blocks. Centerframe supports the underhung crankshaft in main bearing caps which are integrally bolted by vertical cap bolts as well as horizontal locking bolts. Auxiliary drive chain housing also mounts from the rear end of the main engine centerframe.

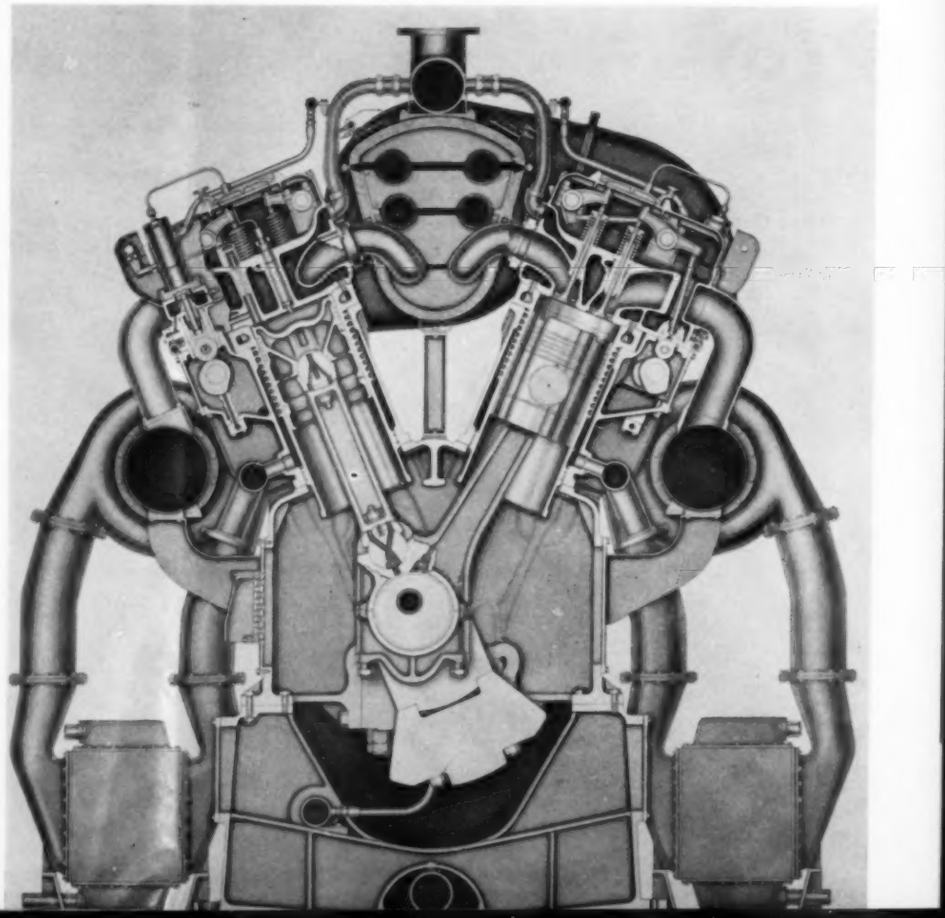
Cylinder Blocks—Two cylinder blocks, one per bank, are utilized on the KSV engine. The camshafts are mounted in the cylinder blocks and are located outboard. Cylinder blocks contain and support the special wet liners utilized.

Cylinder Liners—Cylinder liner construction used on the KSV engine is one of the most important design features permitting high specific output. Liners are cast iron and are porous chrome-plated by Vanderhorst for long wear life and anti-scuffing characteristics. High velocity controlled cooling is designed into the KSV liner. Spiral flutes are cast on the O. D. of the liner to direct water flow upward around the liner to give excellent heat transfer characteristics. A baffle plate is fitted over the spiral flutes to contain the water immediately next to the liner. Another important feature of the liner construction is in the upper water seal between the liner and the block. This seal is removed from the high temperature of the combustion chamber through a unique design of the liner at the upper end. A paper thin asbestos type gasket is used to seal the upper joint. This construction permits water cooling of the sealing area as the water passes upward through the block to the cylinder heads. Eight "O" ring sealed water connection jumpers convey the water from liner to cylinder head.

Crankshaft—Crankshaft used on the KSV engine is a large stiff shaft having 11½ in. main journals and 11½ in. crankpin diameters which is 85 per cent of the cylinder bore diameter. Crankshaft is a steel forging. The main sprocket for the auxiliary drive chain is located at the rear of the shaft to minimize the effect of torsional vibrations. Internal oil hole drilling is located in low stress areas in the crankpin through the use of crankpin oil tubes that eliminate the intersection of oil hole drilling. Bolted-on counterweights are used and may be varied to control balance of the engine for specific applications.

Piston—Cast iron pistons of short length and low weight are used and are tin plated for good initial break-in characteristics. The "cocktail shaker" principle of oil cooling is incorporated in the KSV engine. A heat dam is cast into the crown area of the piston to direct the flow of heat from the combustion chamber away from the





This sectional drawing shows design and arrangement of components described in article. Overspeed governor is Pickering and main governor is Woodward. Viking engine-driven lube oil pump is used. On the diesel version, fuel pumps and injectors are Bendix-Scintilla. For spark ignition, various systems can be used—either Bendix Magneto, American Bosch pulse generator or C-B battery ignition with radial interrupter.

Cross section through the KSV showing articulated rod construction, turbocooler arrangement and design of exhaust manifold.

ring belt area and into the cooling oil chamber. A thin bronze wrist pin bushing is used.

Ring arrangement used on the KSV engine is of design for high rated diesel and gas engines. Rings are supplied by Sealed Power with four compression rings and three oil rings used—two are located above the piston pin and one skirt ring is used below the pin. Two top compression rings are high tensile cast iron and are taper faced and straight cut. The rings are made of SPR-43-1 material for long life and high temperature operation—compatible with the chrome liner material. The two intermediate compression rings are taper faced cast iron and are also straight cut rings. Top oil ring is a double hook conformable oil scraper. The ring is nonventilated but has 6 notches in the lower scraper for control of upper cylinder lubrication. The lower two oil scrapers are also double hook conformable scrapers but are ventilated and are not notched.

Connecting Rod—Articulated rod construction is used. Both the master rod and articulated rod are steel forgings and hardened rod and piston pins are utilized. Oil check valves are utilized at the lower end of each rod to control the flow of oil through the rod to the piston cooling cavity. Cleveland Graphite tri-metal bearings are used in both the connecting rod and the main.

Cylinder Head—Cast iron Meehanite cylinder heads are utilized. The engine has four valves per head—two inlet and two exhaust. Replaceable valve seat inserts of chrome-moly alloy steel are utilized for both the inlet and exhaust locations.

A light aluminum cylinder head cover with an access door encloses the valve mechanism on the head. Provision is made in the head for air starting valves, main valve crosshead guides, compression relief valve, fuel injection nozzle and spark plugs for gas engine operation. Both the inlet and exhaust valves are 4⅛ in. in diameter.

Exhaust Manifold—A Buchi type exhaust manifold using six individual pipes (steel pipes) carries the exhaust gases from the individual cylinders to the turbocharger. Exhaust manifold is of dry construction and is insulated. Light weight aircraft type expansion joints are used to join the various manifold sections together. A piston ring type seal is used to connect the turbocharger pipes into the turbine inlet casing of the turbocharger.

Camshaft—The engine camshafts are chain driven from the crankshaft at the rear end of the engine. Camshafts are one piece and individual cams are keyed to the shaft with dual keys, a main drive key, and a locating key. Camshafts are available for shifting on both the full diesel and gas-diesel operation. The shifting camshaft on the diesel engine is for a direct reverse marine engine and shifting shaft on the gas engine is for improved economical operation at light loads.

Power and Compression Roundup

THE KSV engine introduced in this article was shown for the first time by Cooper-Bessemer in an impressive, well-staged "Power and Compression Roundup" held in the company's Mount Vernon, Ohio and Grove City, Pa. plants during the week of May 14. In total, over 200 officials from the petroleum, utility, and marine industry were guests of the company with visits and programming scheduled on a two-day basis. Participating from DIESEL AND GAS ENGINE PROGRESS Magazine were Bruce W. Wadman, Executive Vice President, and Managing Editor Robert E. Schulz. This story on the new KSV engine is the first of several very important developments to be released by Cooper-Bessemer. In future issues of the Magazine, consistent with completion of development and testing programs, we will feature additional articles on products and systems demonstrated by Cooper-Bessemer during the Roundup. Among these is an electronic ignition system which consists of a velocity type magnetic pickup, a power supply, and a patent-applied-for amplifier-driver unit. This system, with no moving parts, offers precision timing settings with no drift over long periods of time. Also in the En-Tronics Control Lab of Cooper-Bessemer is a Varsudi Controller which is being designed for maintaining full rated torque on an engine or motor-driven compressor over the speed range and preventing the equipment from being over loaded. On the Mount Vernon test floor, a standard two-cycle model GMVG gas engine was fitted and operated with the Cooper-Bessemer fuel-air ratio control that has been used since 1953 on the company's line of four-cycle high-compression supercharged gas engines. Combustion controls consist of a fuel-air ratio controller that hydraulically operates an exhaust bypass for supercharging level, and a scavenging air throttle for controlling the quantity of scavenging air flow. Lower fuel consumption at reduced torques, wider operating speed range, and lower maintenance are the features. For gas compression application, a new en-bloc integral angle compressor engine was also displayed. Of the two-cycle type, this prototype engine will augment the 20 in. stroke engine and permit larger power packages—up to 16 cylinders with 8 compressor cylinders. Shown also in Mt. Vernon was another entry by Cooper-Bessemer into the gas turbine power field, this the 2,500 hp, 9,000 rpm RT-129 industrial unit. In addition, the Company demonstrated under load the first

In the Cooper-Bessemer En-Tronics control lab, Bruce W. Wadman (left) and Robert E. Schulz of DIESEL AND GAS ENGINE PROGRESS look over the printed circuit display. All guests wore the Texas Stetsons.

pure turbocharged GMW two-cycle integral engine compressor. In contrast to the series turbocharging system now being used, the system under development employs three small steam-type nozzles that spin the blower impeller during the starting sequence with air from the engine's compressed air starting system. This starting assist is never in operation for over five minutes, and the engine then uses its own exhaust gases to drive the turbocharger.

GAS ENGINES SAVE "COLD CASH" FOR NEW DES MOINES ICE RINK

Recreation Center Utilizes Two Waukesha Natural Gas Units to Drive Refrigeration System While Reducing Costs an Estimated $7,500 a Year

NATURAL gas engines have been moving with increasing frequency in refrigeration and air conditioning applications, a field reserved only a few years ago almost exclusively to electric and other types of power. A recent example is use of two Waukesha natural gas engines in the refrigeration system that provides the ice for the rink of the Des Moines Ice Arena.

The Ice Arena is a new structure on an 85 acre tract on the edge of the city. Built by private capital and completed late last year, the arena is surrounded by a large suburban area and the site also includes a modern driving range and an 18 hole golf course. The arena itself is a fireproof structure housing a standard 200x85 ft. hockey box and has a seating capacity of 4000 persons for year around activities.

Dependability of refrigeration is naturally an important consideration in choosing prime movers for such a system. Failure could fill the books with red ink if scheduled events were to be cancelled because of loss of the ice surface. But dependability itself wasn't the real problem here since either of the two types of power under consideration, electric or gas engines, were both rated dependable from the operating standpoint.

So why gas engines? Primarily because figures based on operating and acquisition costs showed gas engines would provide substantial operating economies over use of electric motors despite the higher initial cost of the gas engines.

Early in the planning stages, engineers for Lewis Motor Supply Co., Waterloo Waukesha Motor dealers, contacted the consulting engineer for the project, learned the refrigeration requirements and went to work. With the cooperation of the Iowa Power & Light Co., they computed comparative costs of acquiring and operating electric motors vs gas engines for the system. Their computations covered 12 pages.

"Selection of natural gas engines was justified on the basis of operating costs," said Maurice Olchoff, the consulting engineer. Olchoff worked up the following table of assumed costs after studying data submitted by Lewis Motor people:

Power demand cost for compressor motors	$2400.00/yr.
Power cost per kw/hr	0.012
Gas cost per therm	0.040
Maintenance cost on motors (safe)	0.00
Maintenance cost per yr., on both engines	1400.00
Ave. gas cu. ft./bhp/hr	9.00

"With the above assumptions the operating costs were estimated as indicated in the table below," continued Olchoff. The unknown factor here was the hours of operation and tonnage in order to establish the yearly load factor compared with the maximum capacity of the plant. The table indicates that with a load factor of 60% there would be a saving of $7,500 per year if gas engines were used. "This would pay the depreciation for the entire refrigeration installations," said the engineer.

Yearly demand	80%	70%	60%	50%	40%
Average tonnage	140	122	105	87.5	70
Operating cost, electric	18,600	14,400	12,800	10,500	8,900
Operating cost, gas	6,650	6,000	5,300	4,700	4,020
Savings	$11,950	$8,400	$7,500	$5,800	$4,880

On the basis of these rather impressive figures the consulting engineer recommended installation of the gas engines. These are Waukesha model WAKC gas engines and each is direct connected to a York 87½ ton Freon 22 compressor and operated at a maximum speed of 1200 rpm to give the arena refrigeration setup a total rated capacity of 175 tons.

The WAKC is a six cylinder engine with bore of 6¼ in. and a 6½ in. stroke for the total

Two Waukesha model WAKC natural gas engines drive York 87½ ton Freon 22 compressors for the ice-making machinery at the arena. Engines are automatically controlled by Engomatic system, maintain compressor speed at setting to provide desired temperature control within 1½ degrees.

The Des Moines Ice Arena is on an 85 acre recreation tract on the edge of that Iowa city. Arena is geared for year around activities.

Arena floor has 200 x 85 ft. hockey box, is also used for professional ice skating shows and skating by public. Pipes, 1½ in. diameter and placed on 4 in. center in the arena floor, carry brine to freeze the rink.

displacement of 1197 cu. in. The naturally aspirated engine can operate on butane, propane or natural gas. The butane rating is 240 cont. hp; for natural gas the rating is about 10% below that figure. Arena units operate on natural gas.

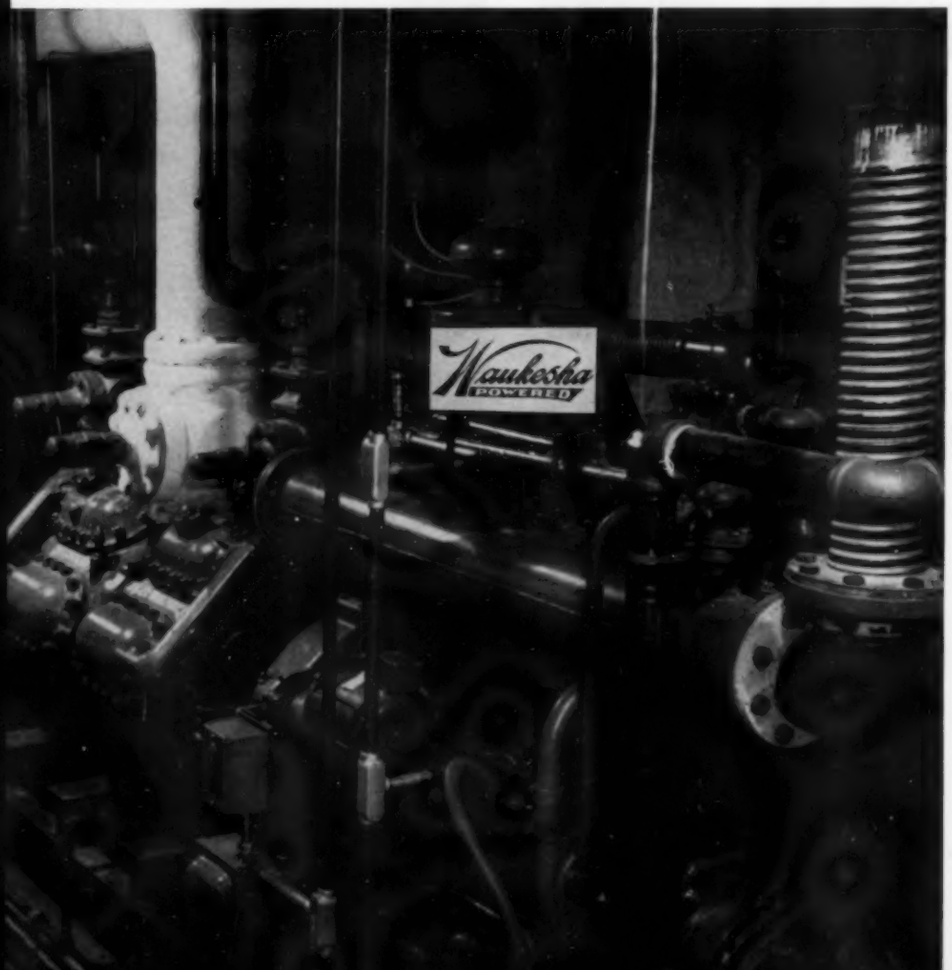
Engomatic control is used on each engine with full automatic start-stop and variable speed control. Controls are actuated by devices which sense the temperature of the brine as it returns from the rink. Engine speed, hence compressor speed, is controlled by the Engomatic system to maintain the desired temperature within ±1½ degrees. Sensing thermostats are adjusted so the second engine does not come on the line until the first unit can no longer handle the load. These adjustments can be reversed periodically so total hours of operation can be equalized between the two units. When the speed of the compressor is below 600 rpm the engine stops. It is automatically restarted when brine temperature rises to a preset limit.

Brine is circulated through 1½ in. pipes on 4 in. centers in the rink floor. During the initial "pull down" of the bare floor prior to the first freeze care had to be taken not to exceed a certain rate of temperature drop due to the possibility of cracking the concrete floor. After reaching about 30 degrees, however, the cracking problem no longer existed and the units were able to be operated at full capacity. Two brine pumps are installed with at least one in operation at all times. Capacity of each pump is 1250 gpm. Brine is cooled by passing it through a flooded type shell and tube brine cooler.

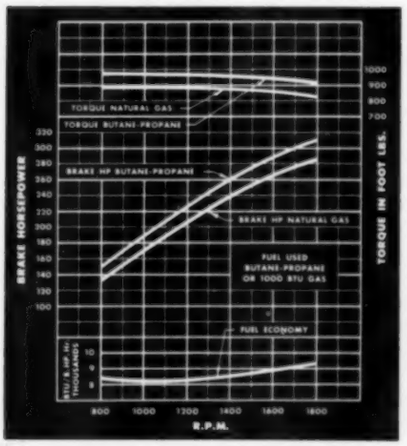
Different ice temperatures, thus surface hardness, are required for public skating, professional figure skating shows and hockey games. The engine control arrangements provide simple thermostat adjustment to effect the required changes.

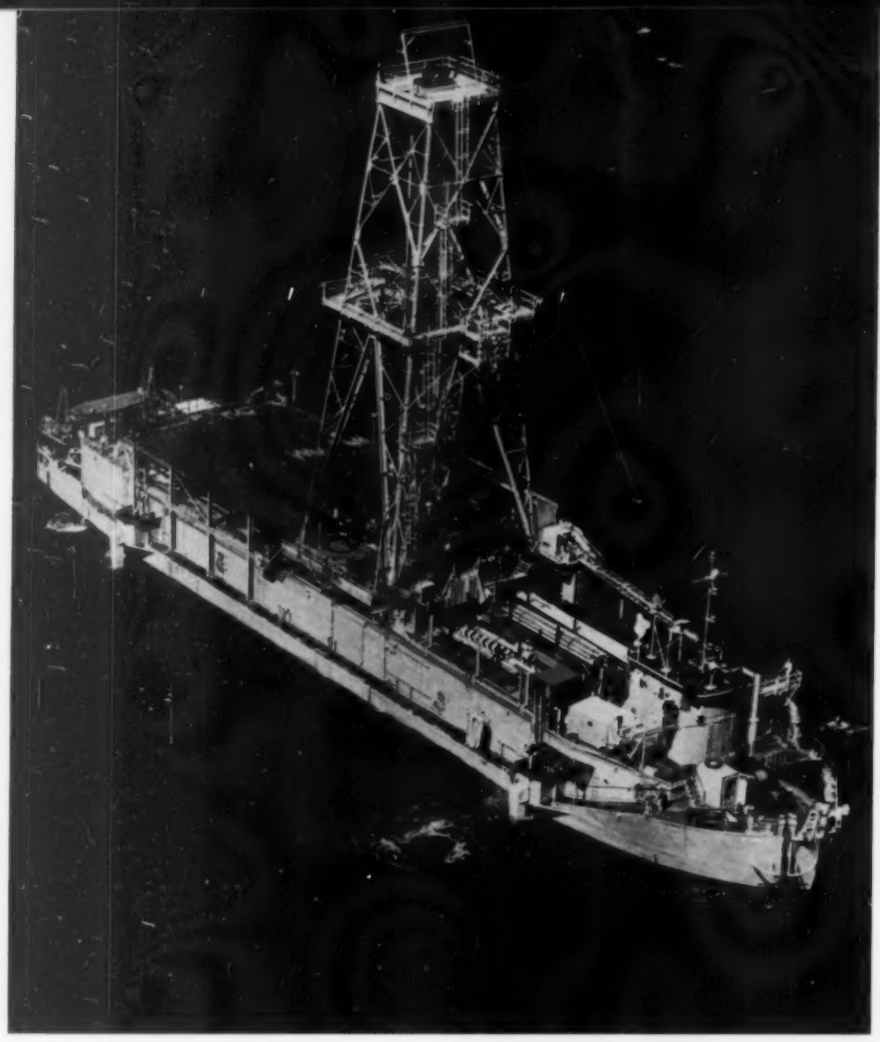
During the January-February operating periods one unit was more than adequate to carry the load and maintain desired ice temperature. For the most part the engines operated at the low end of the variable speed range during those cold-months. Fuel gas consumption costs during that time averaged about 24 cents per hour. The same general conditions applied during the March-April operating period, with one unit at low speed easily handling the load. Due to somewhat higher ambient air temperatures, greater loads were required on the engine and the average fuel gas costs averaged about 28 cents an hour. These fuel costs can be compared with those for a 15 hp electric motor, operating in conjunction with this equipment, which the operators stated cost about 52 cents per hour in electrical energy.

"Based on data available to date, our initial calculations and assumptions have been well supported by actual operating conditions and results," said J. F. Lewis, of Lewis Motor Supply. "And all interested parties seem well satisfied."



Power curve, model WAKC gas engine.





Cuss 1 underway during trials. The 260 ft. drilling ship is owned by Global Marine Exploration Co. Two of four marine tractor units which kept *Cuss 1* on station during drilling can be seen on starboard side, fore and aft.

HARBORMASTERS KEY TO SUCCESSFUL MOHOLE TESTS

Four Murray & Tregurtha 200 HP Outboard Propulsion And Steering Units Keep Unmoored Ship on Station As Drillers Pierce Ocean Floor 12,000 Ft. Below The Surface in Major Scientific Undertaking

PHASE One of Project Mohole was completed in April when scientists succeeded in drilling 600 ft. into the ocean floor from an unmoored and unanchored barge 12,000 ft. above. The experimental deep-sea drilling program was carried out to test techniques and equipment for possible use in achieving Mohole's ultimate aim: to drill through the earth's crust under the ocean to determine the composition and physical properties of the crust and underlying rock known as mantle. And a unique application of Murray & Tregurtha dieselized marine propulsion units contributed markedly to the successful tests. The test drilling was carried out by Global Marine Exploration Co. which converted the *Cuss I*, a 260 ft. drilling ship previously used for offshore operations, under a contract with the National Science Foundation National Research Council. The program is under technical direction of the AMSOC Committee, a private organization of scientists and engineers.

The latest test, conducted near Guadalupe Island off the western coast of Mexico, and an earlier test in 3,000 ft. of water off La Jolla, Calif., used standard rotary drilling methods used on land by the petroleum industry. A main objective of the drilling was to confirm, by test, elaborate engineering computations of the forces and stresses acting on the ship and the drill pipe, determination of the optimum drill rotation speeds and the necessary weight on the bit. All holes are uncased, that is, the only connection between the ship and the sea floor is the drill pipe itself.

One of the major problems to be faced in Project Mohole, and tested in the early drilling, was how to "anchor" the drilling ship when conventional mooring is impractical because of the very great

One of four 200 hp Murray & Tregurtha Harbormaster marine tractors which power the *Cuss 1*. Units, mounted one near each corner of the ship are equipped with GM 6-71 diesel engines, and controlled through specially designed console.

depths involved. The ship could move only a limited distance off the hole, otherwise the drill string would snap. Designers of the equipment met this problem by utilizing what we might call a "hovering" technique. That is, the *Cuss I* was not moored but kept on station by engine power.

This is how they went about it: At four points on the *Cuss I*, engineers installed Murray & Tregurtha Harbormaster F6RP marine propulsion and steering units. One unit was installed fore and aft on the port and on the starboard sides, approximately 190 ft. apart and 16 ft. below the *Cuss I*'s engine deck line. Thus with ship's 48 ft. width, the rectangle was 190 ft. x 48 ft.

The Harbormaster consists of a GM 6-71 diesel rated 200 hp at 2100 rpm, swinging a 60 in. three bladed propeller, through a series of gears to effect the right angle drive, at 308 rpm at a normal engine speed of 1400 rpm. The M & T units are equipped with automatic controls for low lube oil pressure and high jacket water temperature.

The ship's position is determined by a series of buoys anchored to the bottom and equipped with sonar transponders and radar reflectors. Electronic equipment on the ship translates signals received from the buoys into distance and presents this information to the operator, allowing him to know his position relative to the buoys and thus to the hole 12,000 ft. below the barge. Elaborate controls in the wheelhouse allow the pilot to select the desired amount and direction of thrust of the Harbormasters to hold station during the drilling operation. The propeller thrust from the four Harbormasters is controlled by a single vertical lever that allows the operator to simultaneously direct the thrust of the four propellers to move the vessel in the desired direction. A second wheel-shaped control allows the operator to change the ship's heading by rotating the vessel around the drill pipe. Thus with these two simple controls, *Cuss I* can move in any desired direction and speed, allowing precision position that had been previously thought impossible.

Throttle setting of the Harbormasters depends on the wind and sea conditions. They are run engaged at all times and control to the units is via a Westinghouse Air Brake system. Propulsion direction is controlled through a 440 volt, 2 hp steering motor mounted in each unit to turn the vertical outboard shaft in the desired direction. The shaft can be rotated at 2 rpm. Two men were on duty at all times while *Cuss I* was on station. They worked on an "hour on, hour off" basis. Going out to station, the Harbormaster units, in "ahead" position, helped the towing tug along and added four knots to the speed. Throughout the program, the Harbormasters performed extremely well, holding the ship in position within a ship-length for a period of several weeks in winds up to 30 knots and seas up to 12 ft. During the initial sea trial of *Cuss I* with AMSOC modifications, when the ship took a 23 degree roll, one engine went completely underwater without apparent ill effects.

In the La Jolla tests, cores were brought from 760 ft. below the ocean floor, working at ocean depth of 3,140 ft. Off Guadalupe, where ocean depth was 11,700 ft., cores were brought from five holes totaling 2,444 ft., the deepest of these 601 ft. Originally plans had been to penetrate to 1,500 ft. below the ocean floor, but the bit struck basalt at about 555 ft. and directing scientists felt drilling further into this strata would produce no additional information.

The cores brought up in the tests were from depths deeper than any at which samples were previously obtained. Scientists will study these cores while further preparation is being made for the big step to reach the Mohorovicic discontinuity, the ultimate goal. It is expected it will take about two years to select a drilling site and build final equipment for Mohole's next phase. The actual Mohole must be drilled at sea through the thinner suboceanic crust because the crust under

This special console controlled attitude of all four Harbormaster units with the single control "stick" shown. Engine controls are conveniently located to operator. System allows *Cuss I* to keep station closely during critical drilling operations.

continents is too thick to be penetrated. The boundary between the crust and the dense material of the mantle is the Mohorovicic discontinuity (or Moho) after the Yugoslavian seismologist whose studies of earthquake waves first indicated its existences. The proposal for a hole through the Moho has become known as Project Mohole.

Beneath the continents, the crust of the earth has a thickness of 15 to 20 mi., being thickest under mountains while the suboceanic crust may be as thin as 2.5 mi. in some places. The eventual Mohole may be drilled in water as much as 18,000 ft. deep (3.4 mi.) into a thickness of about 15,000 ft. of crustal rock, a total of about 32,000 ft. (6 mi.). The deepest hole drilled from land is just over 25,000 ft. (4.7 mi.) in depth. The mantle, rock underlying the crust, extends down to a depth of about 3,000 mi. and accounts for about 84 per cent of the volume of the earth. Although volcanoes in oceanic areas erupt lava that probably originates in the mantle, lava is not thought to be characteristic of average mantle material. The material below the mantle is called core and may be nickel-iron.

Experiments will be conducted to record the physical properties of the sediments that have been penetrated in the first tests. Data will be sought on the electrical and heat conductivity; seismic velocity and magnetic and gravity observations. Such measurements, along with data obtained when the Mohole is finally drilled, are expected to have great scientific value in enabling scientists to compare data obtained previously by indirect means and thus advance knowledge of the earth's composition and origin.

TRENDS IN DIESEL ENGINE INTERCOOLING

By CALVIN J. KING*

As the urgency for higher specific engine outputs continues to mount, more diesel engine manufacturers are turning to charge-air intercooling as an aid to solving some of their problems. The term intercooling, used here, is in the same sense as would be used by one involved in multi-stage compression. This, in fact, is the case with a supercharged diesel engine where the supercharger represents first stage compression to be followed by further compression in the cylinders prior to fuel injection. The term aftercooling, very commonly used, is equally correct since the diesel engine is not commonly thought of as a compressor but rather a heat-power machine. We will use the term intercooling in our discussion.

Calvin J. King

The diesel engine intercooler is a heat exchanger designed to cool engine-charge air after compression by a supercharger or turbocharger. Since the primary function of this device is to increase charge-air density, it should combine a high cooling effectiveness with minimum air restriction or pressure drop. Cooling effectiveness is usually expressed as a decimal or percentage.

1. $E = \frac{T_1 - T_2}{T_1 - t_1}$ where:

T_1 = Hot fluid (air) inlet temperature to heat exchanger °F.
T_2 = Hot fluid outlet temperature from heat exchanger °F.
t_1 = Cooling fluid inlet temperature.

It is apparent that this is the ratio of actual cooling range to maximum theoretical cooling range possible. Most intercoolers for high-speed diesel engines today are designed for 70 to 85% effectiveness.

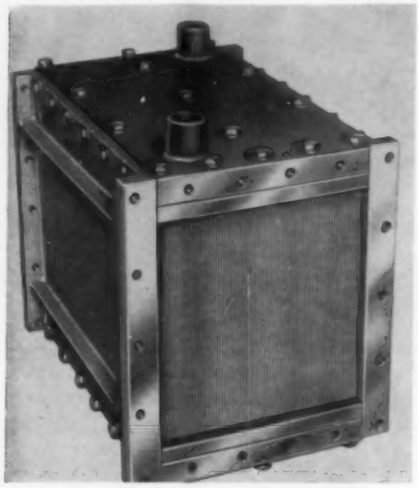
It should be noted at this point, that if flow rates of both fluids are held constant, and if changes of fluid properties affecting heat transfer are neglected, effectiveness remains constant. Heat transferred is given by the equation:

2. $H = MC_P (T_1 - T_2)$ where:

H = Heat Transfer Btu/Hr.
M = Mass Flow Lbs./Hr. of Hot Fluid
C_P = Specific heat at Constant pressure $\frac{\text{Btu}}{\text{Lb. x °F}}$

Therefore, "H" varies directly as $(T_1 - t_2)$ since from (1) $T_1 - T_2 = E\ (T_1 - t_1)$. This relationship is true within reasonable temperature limits where fluid properties of air or water in this case do not vary drastically. Therefore, with a given set of flow rates and heat exchanger, it is obviously advantageous to use the coldest coolant available for this service.

Most intercoolers on American-built diesels use use water as a coolant. This is either engine jacket water, after radiator cooling at a temperature of 180° to 190° F.; or raw water, either fresh or salt. External water is usually available at 60° to 90° F. It is not uncommon on large, low-speed, stationary applications to cool to within 5 to 10° F. of coolant temperature which may represent 95 to 97% cooling effectiveness. However, with 90° cooling water and an intercooler 80% effective, 390° F. air can be cooled to 150° F. With 190° F. coolant, outlet air temperature would be 230° F.



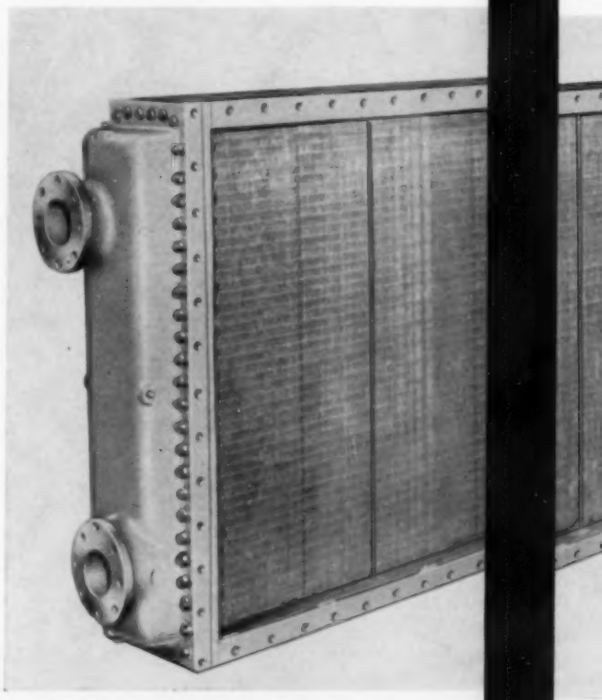
Water-to-air intercooler for 250 hp marine diesel cooled with sea water. Built to MIL-C-19713 specifications.

What benefits are derived from intercooling? Tests were recently run by two different manufacturers of four-cycle diesel engines using regular production intercoolers built by Perfex. Engines were in the speed range of 1200 to 2400 rpm and the power range of 350 to 1000 bhp. Turbocharger pressure ratios were both on the order of 2 to 1. Comparisons refer to the turbocharged, intercooled engine as related to the turbocharged, non-intercooled version of the same engine.

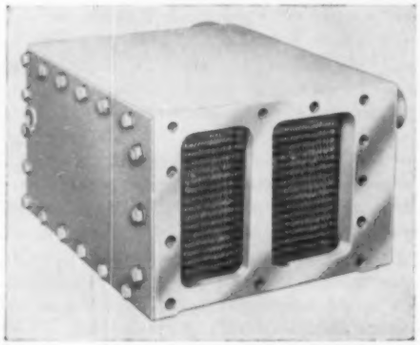
1. Depending on inlet manifold temperature or extent of intercooling, 3 to 5% decrease in basic specific fuel consumption at rated horsepower and speed.

2. With the same lbs./hr. fuel delivery results, 5 to 6% increase in full load brake horsepower is attained.

3. With increased fuel delivery to maintain the same fuel-air ratio, an increase of 10 to 20% in brake horsepower at rated speed results.

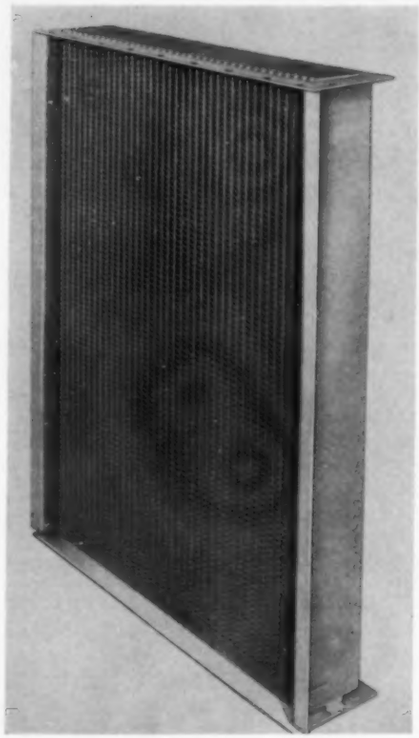


First stage intercooler for 9000 hp turbocharged engine. Air-to-water type used on diesel for electric power generation.

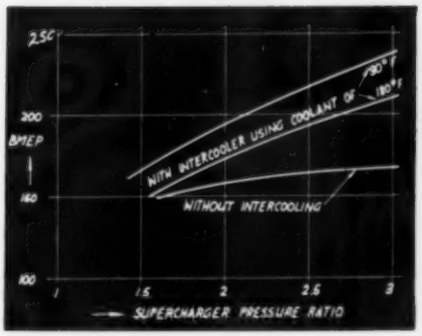


Mobile application for approx. 150 hp diesel. Two-pass on air side using jacket water as coolant.

Mr. King has been involved in thermal and mechanical design of intercoolers since joining the Perfex Corp., of Milwaukee, Wis., in 1959. His extensive heat transfer experience stems from association with Yuba Consolidated Industries and GM's Harrison Radiator Division.



Air-to-air intercooler without tanks. Mounted on same air stream as engine jacket water radiator. Single pass both sides for mobile application.



Typical bmep of turbocharged engine for constant exhaust temperature and firing pressure with and without intercooling.

4. 100° F. to 200° F. reductions in exhaust gas temperature occur with the same fuel delivery.

5. When fuel delivery rate is maintained, as with a set injection pump, a 10% reduction in heat rejection by internal engine parts to jacket water results. A further reduction in heat rejection of up to 15% will occur if turbo speed is maintained by using a smaller area nozzle ring. This represents a considerable decrease in thermal loading of the engine. In the case of a jacket water cooled intercooler, the total heat rejection to jacket water through engine and intercooler will remain essentially the same as from the non-intercooled engine at the same horsepower output.

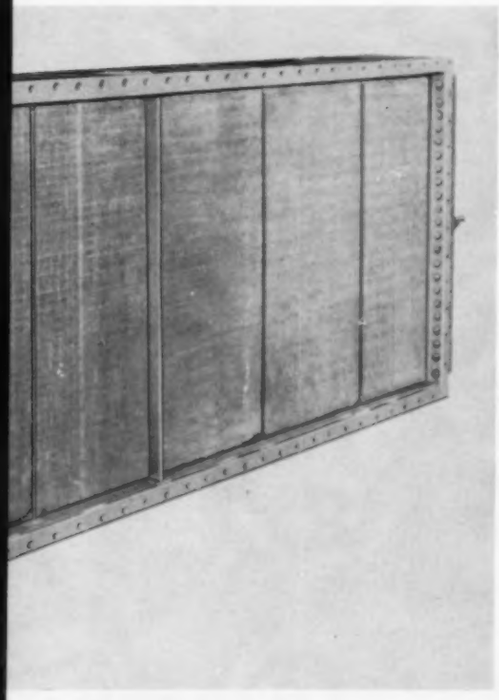
6. With the same fuel delivery, lower firing pressures and exhaust temperatures result. With increased fuel delivery and higher outputs as in 3, the same firing pressure and exhaust temperature conditions can be maintained. (See chart)

7. A reduction in engine oil consumption is generally realized due to lower thermal loading.

This data is not necessarily applicable to two-cycle diesels which apparently do not respond to the same extent as four-cycle diesels to intercooling.

When an intercooler is installed on a turbocharged engine, exhaust gas density will increase and the turbocharger speed will drop off. To bring the turbocharger back to its original speed, a smaller area nozzle ring can be used. This will improve low speed engine performance by maintaining higher turbocharger speed when the engine speed is reduced. Further improvements can be made in low speed engine performance by the use of pressure ratio controls. Briefly, these controls help maintain turbocharger speed at or near the desired maximum throughout approximately the upper 50% of engine speed range. Exhaust gas flow through a small area nozzle ring turbo is varied by partial by-passing around the turbo. As engine speed is reduced, turbo speed is maintained by reducing the amount of by-passed exhaust gas. The use of such controls enhance many of the benefits derived from intercooling, especially at reduced engine speeds.

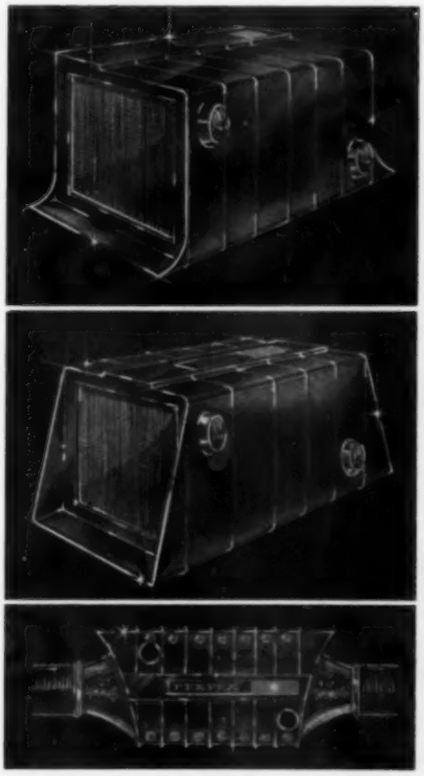
Perfex makes available to engine manufacturers, the proven benefits of intercooling; however, we also believe the intercooler should be treated with esthetic appeal, aiding in the establishment of a clean, rugged appearance of the engine package. The series of sketches depicts the evolution of an air-to-water intercooler design developed by a series of discussions with customer engineers on a specific application. Core size and configuration had previously been fixed; only external details had to be resolved to fit the application. This is not always the case; core selection governed by the available space envelope is usually the major problem.



Shown here are three stages in the evolution of an exterior shell design to aid in establishing clean, attractive appearance of engine package. Top is first design, utilizing ribbing and sand casting. Middle drawing shows cleaner appearance; and bottom drawing shows final design with transition piece cast integral, permitting more rapid installation by engine builder. Curves on transition piece also permit better air flow. All are air-to-water intercoolers.

Intercooling requirements are not static. Design conditions, available space envelopes, choice of heat sinks are all variable. We at Perfex have done considerable work of a development nature with air-to-air intercoolers. Tests have shown that cooling effectiveness in excess of 93% can be attained with moderately sized crossflow cores, similar to the one illustrated, utilizing extended surface in both airstreams. In many cases, carbon steel is a suitable material and offers considerable savings in material costs.

No particular type of heat transfer surface is the best for all applications. In use now are round tube and fin, flat tube and fin, and flat tube and center cores for air-to-water service. Generally for air-to-air service, the plate-type core is best adapted. Shell and tube coolers should not be discounted entirely, although they are certainly not the most efficient in terms of size and weight for air service. There is some indication that on some installations an evaporating refrigerant may be beneficial as the coolant. For this service round tube and fin cores are very suitable.



With Mechanics, Tools and Facilities . . .

SPECIALIZATION INCREASES SERVICE EFFICIENCY AND ECONOMY

By RALPH PONTIUS*

THE diesel engine is as easy to service, repair and overhaul as any other type of engine, but only the mechanic with specialized training using tools and shop equipment carefully arranged and designed specifically for his product can perform these operations with the efficiency and economy required today. In many instances these operations have been performed with a reasonable degree of success and without regard to the time involved, by mechanics responsible for the operation of other type engines and a variety of construction and industrial equipment.

Today, however, it is difficult for any mechanic regardless of his ability to accumulate the knowledge and skill necessary to become proficient in servicing all makes of engines not to mention the wide variety of dieselized equipment now in use. The importance of the specially trained mechanic who knows his product and is fully familiar with the latest factory-approved maintenance and repair procedures cannot be underestimated. But in view of the current profit squeeze experienced by practically every line of business, competent personnel is not the complete answer. Specialized tools and handling equipment carefully laid out to meet product requirements are of equal importance. Tools and shop facilities of wide general application no longer meet today's need for efficiency, minimum downtime and lower repair costs.

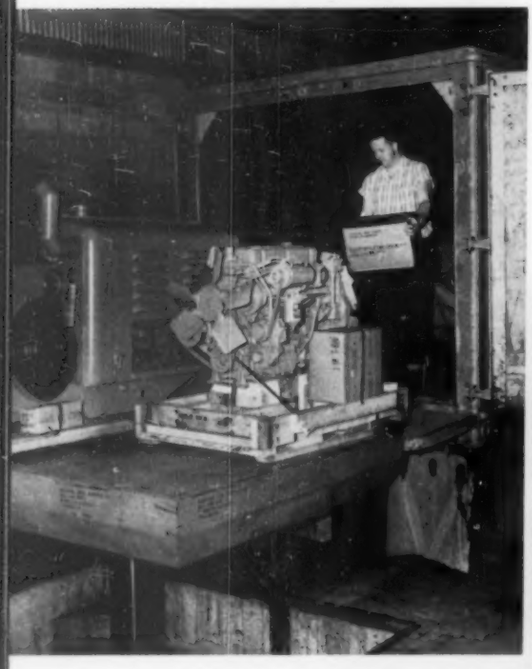
The Detroit Diesel Engine Division of General Motors maintains a department at the factory devoted exclusively to the development of proper tool and shop facilities. Detroit Diesel distributors and dealers participate in the program. They report facilities that have improved their shop operations and in turn receive the counsel of the department when requested. The department gives careful consideration to buildings arranged and adapted solely for engine repair in a manner approaching the factory production line, specialized benches, work areas for each phase of the repair job, fuel injector rooms, modern handling and testing equipment and other items contributing to faster, lower cost, quality work.

A review of these facilities starts right at the shop entrance. A hydraulic lift that meets the level of incoming trucks is a time-saving piece of equipment for unloading engines, parts and supplies. It also offers greater safety for the personnel involved. A small winch at this point moves these items off closed body trucks onto the lift platform where they can be moved by overhead handling equipment. Disassembly and cleaning rooms for engines in for repair or complete overhaul is next in line. Such a room helps save cleaning time and space in the main shop and promotes better working conditions. Lifting equipment and necessary tools located in the room are also time savers. In addition mechanical agitation in the cleaning tank can cut cleaning time 40 to 80 per cent. An inspection bench, just outside the cleaning area, equipped with gauges, micrometers, straight edges, dial indicators, etc., facilitate checking of engine parts after cleaning. At this point a complete list of new parts needed to complete the repair job is compiled and parts accumulated to eliminate later delays.

For easy and fast handling of engines and components from one area to another an overhead bridge crane is a "must". It facilitates the movement of engines and components in all directions, eliminates prying and inching, and enables one man unassisted to perform most assembly operations. Fixtures, jigs and tools specially designed and easily accessible on tool boards for exclusive use in subassembly areas reduce the time required for subassembly operations. The proper tool is always instantly available. Confusion and needless travel to other parts of the shop are eliminated. Proper facilities for rebuilding injectors are costly and require careful planning. A room devoted exclusively to this purpose should be ventilated with filtered air to make it as free from settling dust particles as possible. Special equipment for cleaning and a Comparator for testing the rebuilt unit is a necessity.

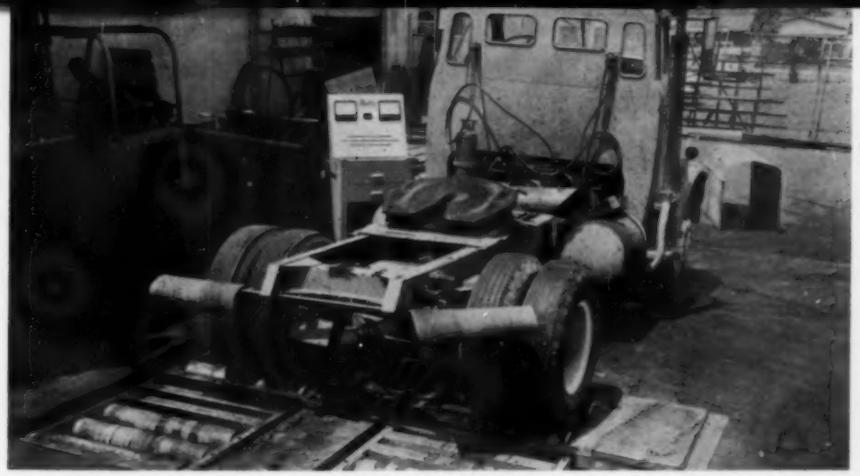
Two dynamometers are now generally accepted as required equipment in the modern diesel shop —an engine dynamometer and a truck chassis dynamometer. Proper run-in is necessary to determine that the performance of an overhauled engine conforms to established factory standards,

Mr. Pontius heads Detroit Diesel Engine Division's Service Facility Development Dept. at the home office in Detroit.



Hydraulic lift at shop entrance of Diesel Equipment Co., Inc., of Wichita, Kan., saves time in unloading engines, parts and supplies.

Trucks completely equipped with parts and tools and manned by competent personnel provide road service for trucks and other on-the-job service. Here service truck delivers a part to a cruiser at a Miami marina.



Chassis dynamometer plays important part in checking work performed on unit. Here tractor undergoes testing with Clayton chassis dynamometer at shop of Anderson-O'Brien Co., Los Angeles GM Diesel distributor.

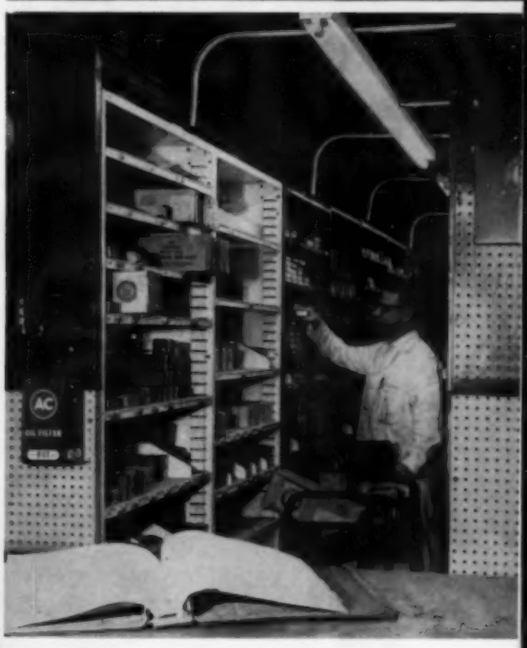
Injector room of Abbott & Glass GM Diesel, Inc., at Salt Lake City, Utah. Operator uses Kent Moore Comparator to test action and output of rebuilt injector. Room is ventilated with filtered air and pressurized to prevent entry of dust particles.

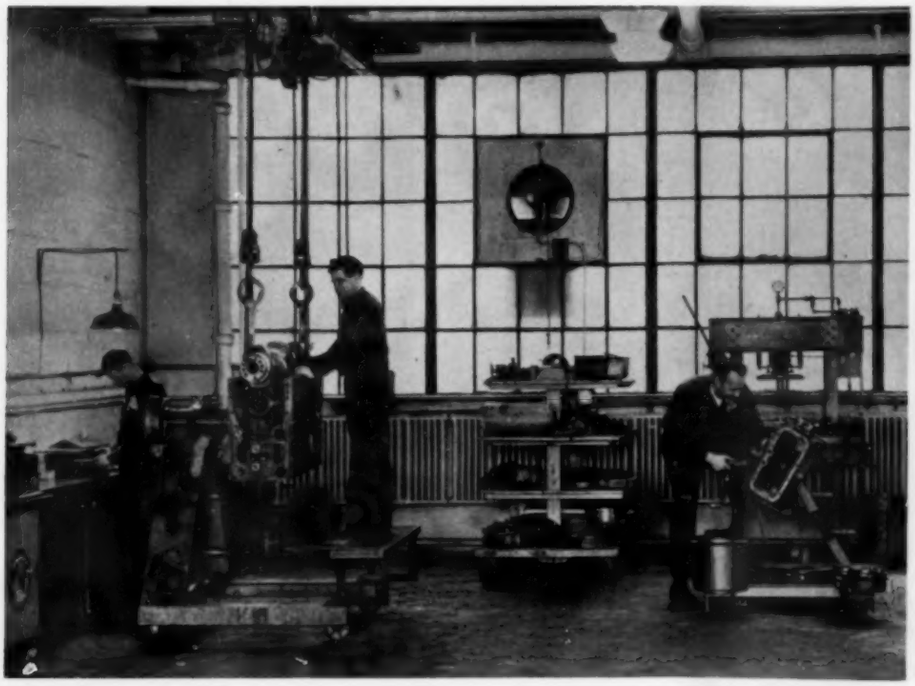
and also guarantees it is ready to go to work delivering full power upon delivery to the job. By means of the chassis dynamometer engines can be checked under actual road conditions without the influence of pre-determined driver opinion, transmission or axle ratios and possible truck component defects. The chassis dynamometer eliminates costly time-consuming road tests.

The servicing of truck engines requires a large area separate from the main shop. Truck bays should be located and designed for easy entry and exit. They should measure a minimum of 15x40 feet. In some instances larger bays may be required for larger truck and trailer combinations.

To fulfill today's requirements the modern diesel shop should have facilities for performing service operations day or night outside the shop—on the owner's job and service for trucks on the highway. This requires service vehicles manned by competent personnel carrying all tools and replacement parts which may be needed. Instant availability of parts is of course of prime importance in speeding up any repair job. A fool-proof inventory control system is a "must" to assure a balanced inventory of parts and to eliminate shortages contributing to excessive downtime.

In order to further increase efficiency, economy and quality work, Detroit Diesel maintains an extensive training program for mechanics both at the factory and by means of mobile training units traveling the entire country. This training on GM diesel engines is available to all shop mechanics. Regular examinations are also given Detroit Diesel mechanics by the Division's Service Craftsman's Guild to assure complete product knowledge and to promote expert quality workmanship at all times. To this end also the Division recently introduced a dynamometer calculator designed for GM diesel mechanics in determining the factory-approved performance characteristics of over 50 GM diesel models instantly at the turn of a dial. This is an important timesaving device which eliminates the possibility of error in determining performance characteristics to be attained before the engine is delivered to the owner. A dynamometer test certificate revealing the engine characteristics attained after overhaul is also available for presentation to owners by Detroit Diesel distributors and dealers.





A portion of Hicklin GM Diesel's parts department at Des Moines, Iowa. A complete supply of parts is safeguarded by a unique parts inventory control system.

View in the shop of Hubbs Engine Co. of Boston illustrates "one man" assembly with assistance of overhead bridge crane in positioning engine.

TWO 4000 HP TOWBOATS FOR OHIO RIVER COMPANY

A PAIR of twins, towboats newly delivered by St. Louis Shipbuilding & Steel Co., in April have been turning in enviable service records for their new owners, The Ohio River Co., of Cincinnati. Christened in April, the *John Ladd Dean* and the *ORCO* have operated over the entire length of the Ohio River and are presently operating in the Lower Ohio between Huntington, W. Va., and Cairo, Ill.

"These vessels have both been in continuous operation since they were delivered and both have given very satisfactory and trouble free performance since placed in commission," said L. R. Fiore, vice president-operations for the company. When open river conditions have permitted larger than locking-size tows, the boats have moved tows of 36 standard 175x26 ft. barges representing a tow covering the equivalent 3.9 acres.

Since the two vessels are similar in construction and power, (both have 4000 Fairbanks, Morse hp) the description of the *John Ladd Dean* which follows applies as well to the *ORCO*.

The *Dean's* hull measures 164x40x11 ft. with a normal draft of 8 ft. The hull is heavily framed longitudinally and transversely with the aft deck raised to provide additional strength to the stern. Extensive self-propelled model tests were conducted at Wageningen, Holland to assure optimum hull, propeller, nozzle and rudder design.

Propulsion power is provided by a pair of Fairbanks, Morse 38D8⅛, 12 cylinder, non-reversing marine diesel engine, each rated 2000 hp at 750 rpm. Each of these main engines drives a 109 in. diameter stainless steel propeller through a Western model PCMR157B reverse and reduction gear with 4:1 ratio. The gears are equipped with Wichita model ATD230HLI clutches. Each of the four-bladed propellers is mounted on a shaft of high tensile alloy steel and each turns in a Kort nozzle which increases thrust by feeding the propeller large masses of water at high velocity.

The main engines are cooled with clear water circulated through a St. Louis Ship closed skin cooling system. Engines are started from the engine room only but engines and clutches are controlled from the pilothouse by means of Westinghouse Air Brake pneumatic equipment.

Each of the new towboats is powered by a pair of Fairbanks, Morse model 38D8⅛ non-reversing diesels rated 2000 hp at 750 rpm. Engines drive through Wichita clutches and Western gears.

John Ladd Dean moves 30-barge tow on Ohio River. Total displacement of this 1040 x 156 ft. tow was over 34,000 tons.

John Ladd Dean and *ORCO* are both 164 x 40 x 11 ft., have normal 8 ft. draft. Vessels were built by St. Louis Ship.

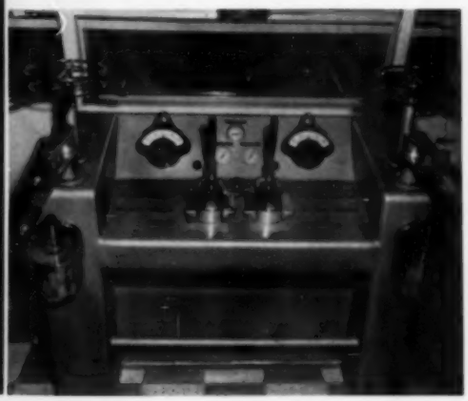
Two steering systems of mechanical-hydraulic type are installed. One system controls the two steering rudders and the other controls the four flanking rudders. Rudders can be turned from hard over to hard over in 17 seconds while towing. A mechanical followup system indicates rudder position in the pilothouse at all times.

Auxiliary electric power is provided by two Caterpillar D342 series C diesel engines, each driving a Louis Allis self-regulated generator rated 85 kw, 3 phase, 220/440 volts. A Lakeshore Electric dead-front type switchboard is equipped with controls for generators, power and lighting circuit panels and is wired for parallel generator operation.

Among the large tows moved by the new vessels up to the time this article was prepared was one handled by the *Dean*. This tow consisted of 30 barges including 28 barges of coal, one liquid chemical barge, and one self unloading cement barge. The tow was moved on the Upper Ohio River. Total displacement of the 1040x156 ft. tow (see cut) was over 34,000 tons with over 27,000 tons of cargo. The *Dean* produced over 4 million cargo ton miles in a 24 hr. period with the tow despite spending a total of 4.2 hrs. of this time in harbor and landing work, making tow and delivering barges. "The *Dean* and the *ORCO* have demonstrated their ability to handle any tows which the Transportation Department has given up to this time," said Fiore.

Completion of the two vessels brought to 16 the number of towboats supplied the Ohio River Co., by St. Louis Ship. The 4000 hp on the *Dean* and the *ORCO* make them the most powerful of the fleet, which ranges to 1050 hp.

Pilots station of the *John Ladd Dean*. Pilot controls engines and clutches from this station.



For P&D and Intercity Service . . .

130 HP DIESEL TRUCK WORKS TWO WAYS

By ROBERT E. SCHULZ

CHICAGO, Ill.—If you are looking for ways to cut down your operating costs and upgrade customer service, a new truck designed for over-the-road transport and in-city delivery may be the answer. This was the opinion of Orville A. Brouer, general superintendent of the Automotive Section, Swift & Co., as he and I discussed the unique Wolfwagon now being built by St. Louis Car Co. Named after its designer Lloyd J. Wolf, the vehicle presents a new transportation concept—the ability of coupling two or more self-powered trucks together and moving them from one city to another with a single driver. At the destination point, the trucks are uncoupled and with drivers supplied to each vehicle, the units move out into in-city pickup and/or delivery service. Adding further flexibility to the "wagon" is a "lift-off" body with the economy of interchangeable containers.

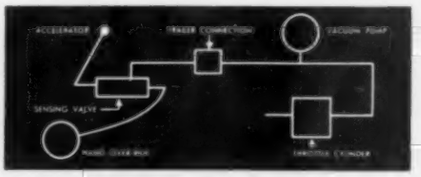
Development of the Wolfwagen started in Dallas and one of the most interested parties early in 1958 was Superintendent Brouer who visualized the value of this mode of transportation for delivery of Swift meat products. Working closely with Wolf, now assistant vice president of St. Louis Car Co. in charge of the Wolfwagon Division, an experimental two-unit train was produced and powered with 200 hp Chevrolet gasoline engines. It was placed in service by Swift and operated out of its Ft. Worth packing plant. Proved practical with several modifications to meet Swift's operating requirements, the pilot model work was culminated with a production order by Swift for 28 wagons, all of which are powered by the Cummins JNF-130 diesel. The first two of these units began operation in St. Paul in late April and 15 more are slated for this packing plant. The balance of this initial order will be delivered to plants in Baltimore, Kansas City, and San Francisco. Other Swift plants will put Wolfwagons into use in the near future.

Wolfwagons are from 20 to 24 ft. in length with gvw ratings from 24,000 to 43,000 lbs. Each of the Swift units is rated 28,500 gvw with a load of 14,000 lbs., and the tandem overall is 49 ft. In the original wagon tested by Swift, the gasoline engine was underslung amidships in the chassis, but in the diesel version as illustrated the engine is hooded and side by the one man cab. Radiator, of course, was moved into the open and the transmission heat exchanger moved forward which combined to eliminate some cooling problems.

Each vehicle has its own complete control system for independent operation. However, two, three or more wagons can be hooked together and driven as a train with a single driver in the leading wagon. To achieve this, designer Wolf has come up with a unique set of controls that link all vehicles. These are essentially sensing valves actuated by positive vacuum. For throttle control, the sensing valve is located in the lead unit as shown in the diagramatic drawing and the vacuum pump driven by the engine of the towed unit. The sensing valve determines the amount of throttle opening required by the lead unit. This requirement is signalled to the towed unit or units and the throttles are opened a proportionate amount. Each road and load condition thus is instantly met without thought on the driver's part. Gears are shifted automatically or at the driver's choice since a hand control valve provides complete override of the automatic throttle. Each unit has an independent braking system plus another for powered combination operation. When coupled, the system works exactly the same as if the towed unit was a trailer. System selection is through a valve in the driver's cab.

Lower operating costs, better product quality and customer service, and streamlined packing procedures were the four main factors in Swift's move to the Wolfwagons. Why diesel? As Superintendent Brouer explained, "We've been diesel-oriented now for a number of years recognizing primarily the fuel and maintenance economy of this power. Also, the new small diesels have moved along well in development to the point where weight is not a problem."

"Just typical of this," Brouer said, "is a 130 hp, 39,000 gvw diesel truck in daily delivery service between St. Louis and Evansville, Ind. The truck, making 35 stops enroute, arrives in the Evansville area empty, picks up a return load and heads back to St. Louis. A lot of stop and go service with plenty of idling. For a year's operation, the truck has averaged 9.2 mpg compared to gasoline engined trucks in similar service with 5.25 mpg." This experience was comparable to the original



Schematic of the Wolf control system for the powered combinations. Refer to article for complete description.

Here is the "old and the new"—the original wagon used by Swift in 1855 and the first two diesel Wolfwagons delivered in St. Paul in late April. Swift Superintendent at St. Paul, T. A. Ray receives the keys from designer Lloyd Wolf. Wolfwagons are powered by Cummins JNF-130 diesels and are equipped with Luberfiner oil filters and Donaldson dry type air filters.

set of wagons Swift tested prior to their production order. With these units in the 285 mile Ft. Worth to Lubbock, Tex., run, the average mileage was 5.5 mpg and this is sharply contrasted to the 9 mpg Swift's St. Paul plant is reporting on the Cummins JNF-130 powered Wolfwagons.

In all of the new Swift wagons, Cummins 130 hp diesels are used—a four-cycle, six cylinder, 4½ in. by 5 in., naturally aspirated engine rated at a governed speed of 2800 rpm. The engine drives through an Allison model MT41L fully automatic, six step transmission. This transmission with a single stage torque converter and down-hill brake retarder built-in was developed for this service by Allison with the cooperation of Wolf and Cummins engineers. It is proving very satisfactory. The rear axle is an 18,500 lb. Eaton, front axle a 10,000 lb. Shuler and steel wire cord tires are used for their cooler operation and greater load carrying ability according to Brouer.

Commenting further on their operation, Brouer pointed to the fact that fuel economy is not the only factor in selecting diesels—lower maintenance being tremendously important. Since none of their packing plants are set up for PM service and none of the vehicles are garaged, Swift has entered into an agreement where Cummins dealers handle all warranty and maintenance. To familiarize dealer shop personnel with the engine and transmission, special service schools were set up at Allison. Superintendent Brouer expects that the units will average 50 to 60,000 miles a year, and based again on previous experience is anticipating 200,000 miles or more before the first major overhaul.

The motorized containers were also termed a "real plus" by Brouer from the standpoint of product quality. Deterioration is always a problem with meat packers and great care must be taken to prevent spoilage. Prior to use of the Wolfwagons, meat was loaded in a refrigerated trailer as it came down from the packing room. The trailer delivered it to the terminal where it was unloaded, set up into orders, and reloaded for local customer delivery. Now Swift has gone to assembly type packing, setting up the customer's order in the plant and once it is loaded it is not touched until it reaches the customer. To carry this streamlined procedure one step further, the St. Paul plant is now converting to conveyorized packing.

Presently, Superintendent Brouer does not anticipate that Swift will be operating more than two-unit combinations. These will be run practically on a round-the-clock pattern six days a week. After container packing in St. Paul as an example, the units will be dispatched with a single driver to destination points within a 300 mile radius. Here they will be uncoupled and turned over to driver for local delivery. At the end of the day, they are again coupled, turned back to the driver and returned to St. Paul for packing the following day's orders. Traveling light, only the diesel in the lead unit is used. However, to prevent motoring and consequent overheating of the transmission in the trailing unit, the Swift wagons have been designed with a quick disconnect sleeve on the drive line.

Swift has closely figured their savings with the Cummins-powered Wolfwagons; however, this information is not available. Suffice to say that the economy and flexibility is a real bonus.

Swift is not the only company that has seen the advantages of the Wolfwagon. According to reports, there are now some 50 units in service. Mobil Oil Co. experimented with 4-unit trains but is now using Wolfwagons in other ways. Other users, in addition, are Interstate Dress Carriers, Inc., of Lehighton, Pa., and Central Freight Lines, Inc., of Waco, Tex.

Allison MT41L six-step automatic transmission with single stage torque converter and down-hill brake retarder is used on the Swift Wolfwagons.

Swift wagon close-up shows tow bar, single driver cab with jump seat. Thermo King propane gas reefer units are used.

Mechanic puts the finishing touches on the installation of a 3-53 diesel engine in a Chevrolet "Viking" truck.

SALT COMPANY EXPANDS UNDERGROUND DIESEL FLEET

By JIM BROWN

THE International Salt Co., which has miles of underground excavation for rock salt under the streets of southwestern Detroit and Melvindale recently added three new Chevrolet trucks outfitted with GM Series 53 diesel engines to their already considerable fleet of diesel equipment used underground. (See DIESEL AND GAS ENGINE PROGRESS, May, 1961.) The trucks, purchased from Shalla Chevrolet Co. of Detroit, are two "Apache 10" ½-ton, 4-wheel-drive pickups and a "Viking 60" cab and chassis.

Before delivery to International Salt Co. the trucks made a stop-over at Peninsular Diesel, Inc., where the standard Chevrolet engines were removed and 97 bhp 3-53 diesels were installed. Peninsular Diesel was well prepared for the job, both in know-how and in equipment, and each of the trucks was repowered in just 40 man-hours, with two men assigned to the job.

No structural or equipment changes were required in any of the trucks to permit installation of the 3-53 diesel engines except that a small (about 6 in.) strip had to be whittled out of the fire-wall of the ½-ton pickups to eliminate interference there. The trucks were ordered with 11 in. clutches and the original Chevrolet "New Process" 4-speed transmissions were retained. Used with these transmissions the top speed (2800 rpm) of the 3-53 diesel engines will result in a small reduction of maximum truck speed, but with a self-imposed "speed limit" of 25 mph in the mine, a change of transmissions or axle ratios was not justified. The higher low-speed torque of the diesel engines will come in mighty handy in the mine where loose salt, which has a deterrent action similar to snow, is often encountered near the working faces. Presence of the loose salt also explains why the two ½-ton pickups were ordered with 4-wheel drive.

Both of the new ½-ton Chevrolet pickups in the salt mine will be used, to some degree, as personnel carriers. One is assigned to the Maintenance Department and will carry maintenance personnel, tools and small pieces of equipment such as pumps from job to job as required. The other will be used by production foremen, to carry them about in the mine and to transport some of the production workers. Both of these trucks have benches mounted in the pickup body.

The larger "Viking 60" truck, normally rated as a 2-ton truck (19,500 lbs. gvw) was delivered as a cab and chassis only, and was lowered into the mine without any additional body. When assembled in the mine it will have two tanks mounted on it and will be used to transport

GM 3-53 diesel engine slips into Chevrolet Viking 60 Chassis with room to spare. Fan was later shrouded up to radiator.

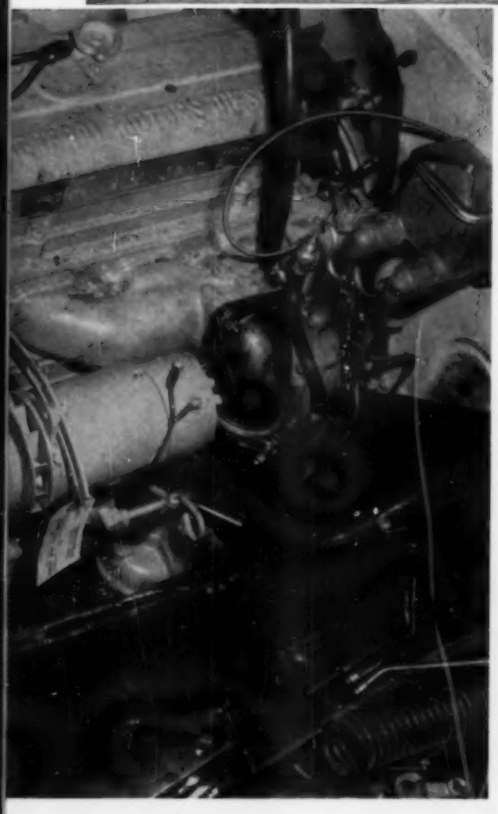
International Salt Co., tipples and hoisting buildings at southwestern Detroit mine. The main shaft is the one down which the Chevrolet trucks were lowered.

fuel and water to the many pieces of engine-driven equipment used in the mine.

There are only two access shafts to the International Salt mine and most of the men, products and machinery are transported between the mine level and the surface in one of the two. Every new, large piece of equipment which has to be lowered into the mine presents a new challenge. The main shaft, while 16 ft. in overall diameter, is subdivided vertically into segments and rectangles for different purposes. Two segments of the circle, for example, provide a passageway for fresh air to enter the mine, while the "skip" ways serve as passages for air exhausted from the mine. Two skips are provided for the removal of salt, with one ascending as the other descends and the same means are used to carry the salt miners in and out of the mine at every change of shift. These skips operate in side-by-side rectangular spaces which are only five feet by six feet. When any piece of equipment is lowered into the mine it must be made to fit into one of these five-by-six spaces. Generally this can be done by disassembling the equipment, but sometimes it must be cut apart with torches in order to fit.

Due to the ceiling height of the mine (which allows some angling of the pieces at the bottom of the shaft) it is possible to lower some pieces such as steel beams which are as much as 28 ft. long. However, since all large pieces are lowered by being chained to the bottom of the skip, they must be carefully crated, with "cross-heads" at top and bottom to prevent any possibility of their swaying or twisting in the shaft while being lowered.

International Salt Co.'s three new Chevrolet trucks with 3-53 diesel engines will bring the company's total number of diesels operating below ground in this mine to approximately 20. It is the intention of the company to go "all diesel" eventually in its operation of equipment which is not electrically driven.



Stripped-down chassis with engine in place is snaked into place under the "skip" by means of overhead crane. Front wheels and axles shown here, were later removed.

Dieselized Chevrolet "Apache 10" pick-up truck, here driven by Jim MacDonald, company mining engineer, pauses before one of the mine's working faces.

Gas Turbine Progress . . .

INDUSTRIAL JET POWERED TURBINE UNITS

SINCE 1958, Cooper-Bessemer Corporation has been developing a design concept for application of the gas turbine prime mover system to products they build and markets served like gas transmission, chemical and petrochemical processing, electric power generation, and marine.

The first consideration was to select a gas generator to provide hot gas energy to drive a free power turbine most efficiently and economically. It was decided that the high efficiency aircraft type jet engine, not requiring a heat exchanger and adapted to burn a variety of fuels like fuel oil and natural gas, would be desirable as a gas generator. Cooper-Bessemer thus undertook a development program with Pratt & Whitney Aircraft to utilize the Pratt & Whitney twin spool type jet engine initially as the energy source for the gas turbine package.

The next step was to develop a power turbine of heavy duty design that would serve as a long life power unit to drive a centrifugal compressor, generator, etc.

This concept has been turned into actual hardware which has undergone extensive laboratory testing and is now accumulating a good backlog of field experience. As is well known, the first field installation is a gas pipeline centrifugal compressor unit at the Clementsville, Ky., compressor station of Columbia Gulf Transmission Co. (This installation has been covered extensively in the November 1959 and January 1961 issues of D&GEP.) The particular unit is Cooper-Bessemer's model RT-248 with a 10,500 hp rating.

The success of the economics and preformance at Clementsville coupled with continuing development work that is being conducted has led to the announcement by Cooper-Bessemer that this type of gas turbine package is now being commercially offered for a variety of prime mover functions. The program, until recently considered still in the experimental and evaluation stage, now is proceeding toward a full-scale commercial product family.

Let's take a closer look at the major design features of the package to analyze the economic and operating advantages.

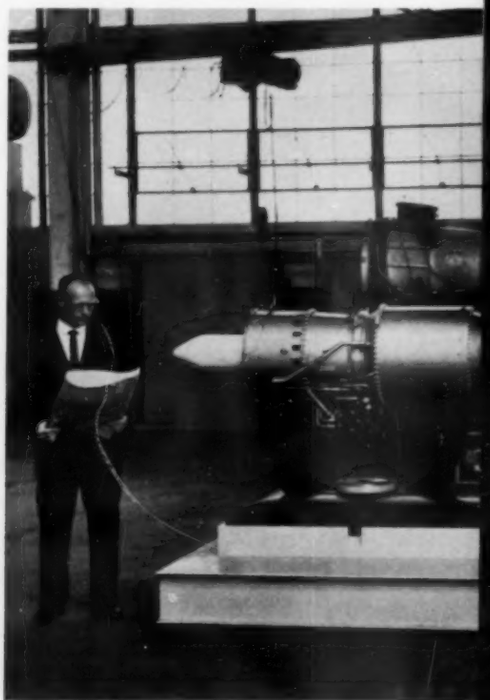
1.—Gas generator—The successful application of the efficient Pratt & Whitney Aircraft jet engine to industrial type service has contributed very significantly to the good economics of the gas turbine units. This engine is light in weight, of minimum size, needs little in the way of foundation and lends itself to the factory packaged concept to facilitate efficient, low-cost installations. Engine mounted auxiliaries and aircraft type supports result in minimum down-time for engine change-out.

This gas generator type has low inertia rotating members and therefore adapts easily and quickly to load and operating fluctuations. As the unit is essentially mass-produced and to aircraft requirements, the turbine blades are made of a very high quality super alloy that can handle a wide range of temperature transients without damage, giving a good safety factor under overload conditions.

Integral gas-generator mounted gear pad provides a source for moderate auxiliary power when required. Engine mounted auxiliaries have few connections and attachments to minimize field labor.

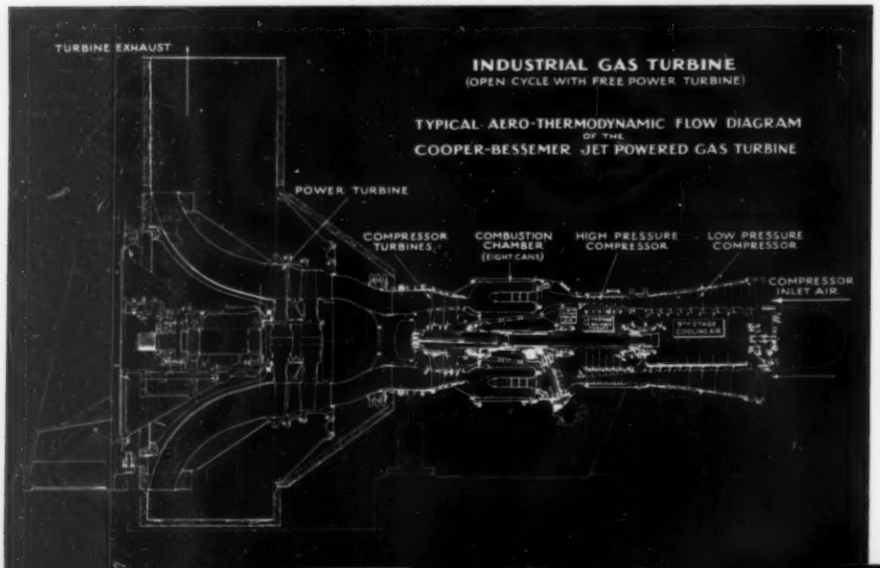
The maintenance factor is a major consideration in analyzing the economics of successfully applying this gas generator industrially. The gas generator has a finite life between overhauls as compared to the long life power turbine section. A unit exchange maintenance program has been set up by Cooper-Bessemer on the gas generator. Currently, particularly in gas transmission mainline operation, gas generator life between major overhauls is being figured at one year or about 8,000 hours. All accessories and auxiliaries are also designed for at least this overhaul period. With the unit exchange plan, a minimum downtime of about four hours will be required for change-out, and maintenance cost under this unit exchange arrangement, according to Cooper-Bessemer engineers, will be competitive with other type prime movers. Cooper-Bessemer will stock replacement units in their warehouses throughout the country so that customers will not have to carry exchange units in inventory.

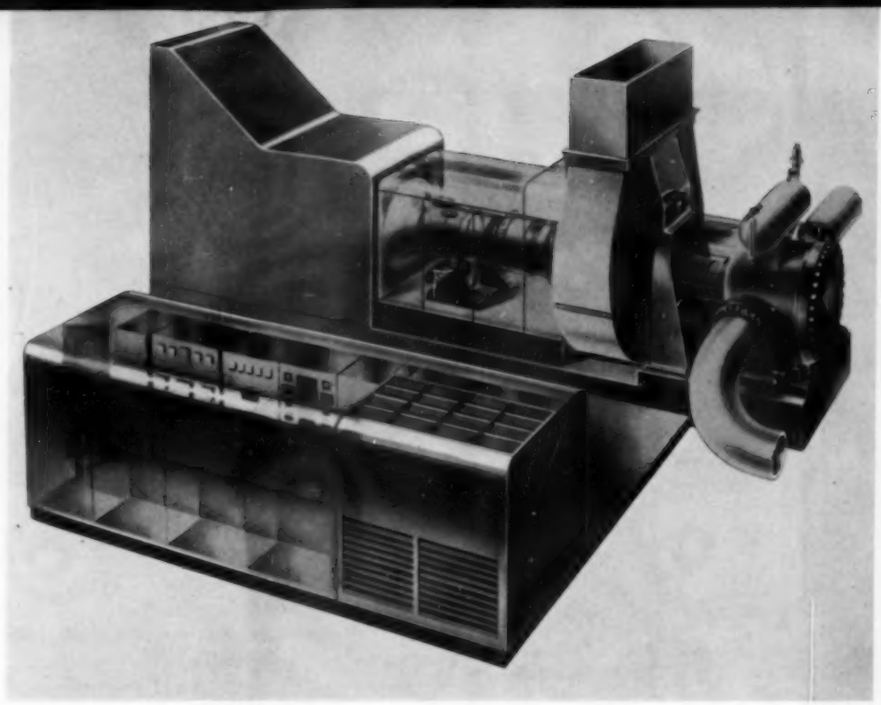
2.—Power turbine—This unit is designed and built by Cooper-Bessemer and is of the heavy duty type for permanent installation along with the exhaust ducting and connections to the driven unit such as a centrifugal compressor. To illustrate the heavy duty design, the bearing arrangement is worthy of mention. A conventional Kingsbury thrust bearing is installed at the tail shaft, but two special sleeve bearings of the tilting pad type are employed on the power turbine shaft. These bearings can carry heavy loads as well as absorb misalignment that may occur between the power turbine and the driven unit. This bearing design



Full scale mockup of 2500 hp Model RT-129 jet engine powered gas turbine, shown at recent Cooper-Bessemer Power and Compression Roundup, and which is next in the new gas turbine product series. A Pratt & Whitney Aircraft gas generator is utilized in this Cooper-Bessemer gas turbine package.

Sectional drawing of gas generator—power turbine combination. Note bearing arrangement in power turbine that is described in the text; also low mass construction of gas generator rotating members to give quick control response.



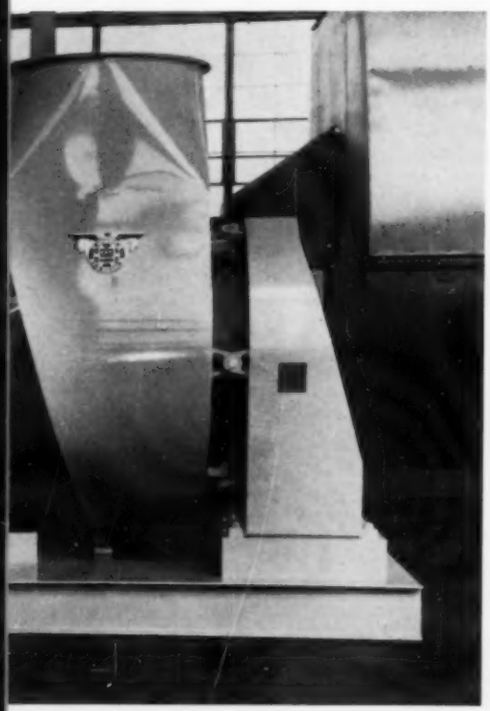


Packaged jet-powered gas turbine compressor utilizing the Cooper-Bessemer model RT-248 unit rated at 10,500 hp. This artist's conception is of an actual installation under construction. Controls for turbine and station are mounted on auxiliary skid along with oil coolers for jet engine and power turbine lube oil systems. Inlet air filter and silencing chamber is at left, then the jet engine-gas generator with removable enclosure, power turbine enclosed in exhaust ducting and finally the centrifugal compressor.

will give long life under all types of operating conditions. The power turbine is a two-stage unit with a good quality super alloy material in the turbine blades and gas temperatures in the 850-1000 degree area, which is an environment that also promotes long life. In fact, it is very similar to the conditions found in turbocharger turbines, which Cooper-Bessemer has built for years.

3.—Packaging and Control Systems—Good packaging and control systems provide a key part of the economics of these gas turbines. The lightweight gas generator makes it feasible to build the simplified, low cost permanent installation. The accompanying illustration of an RT-248 centrifugal compressor for pipeline application clearly shows the low installation requirements for this 10,500 hp unit. In the main plant at Mt. Vernon, Ohio, and at C-B Southern, in Houston, Tex., excellent facilities are set up for packaging of the gas turbines.

Controls complete the picture. Cooper-Bessemer's En-Tronics Division designs and produces control systems for automatic, remote control and/or combination controls of all types. A typical controls setup for the pipeline centrifugal compressor unit illustrated for remote-automatic operation consists of the following major components:



Cooper-Bessemer En-Tronic Control Systems for gas turbines are all-electric systems using relays and static controls.

Fuel Control System. The components necessary to control the fuel throughout the jet engine are in this system. The fuel control system is part of the jet engine, as a matter of fact. The sequence panel signals this fuel control system when to operate, however.

Sequencing System. The sequencing system itself is designed by Cooper-Bessemer and contains all the parameters for control of the unit and the equipment associated with the unit, i.e.: pumps, cooling fans, yard valves, and initiating signals for remote control. Packaged gas turbine units will be two-skidded . . . one skid under the unit itself and one skid under the controls and auxiliary equipment.

Magnetic Pick-Up. A magnetic pick-up is used in the sequencing system for speed readouts and control. Advantage of the magnetic pick-up is that it has no moving parts and won't wear out.

Powering Auxiliary Equipment. The voltage to run the battery chargers, pumps and other auxiliary equipment will be picked up off the gas generator, in the case of a compressor installation, or directly off the electric generator in a power application. Completely self-sustaining and self-contained, these units will run literally "in the middle of nowhere." Starting of the units is done with batteries. Standard available items are used in En-Tronic sequencing systems, thereby not limiting a customer to specialized parts.

Alarms. Most remote stations have very few alarms. If a given condition, such as low oil pressure, can be tolerated for 48 hrs. without damage then it can be considered an alarm. It becomes a shutdown if it can't be tolerated for 48 hrs. Shutdown functions are held this way to a minimum. The operation works under a watchdog type of control, where certain functions must happen within a given length of time.

BASIC SAFETY DEVICES
(Gas turbine and compressor)

Malfunction	*Device*
Jet Gas-Generator	
1. Overspeed	Magnetic pick-up
2. Low oil pressure	Pressure switch
3. Vibration	Vibration pick-up
Compressor	
1. Low oil pressure	Pressure switch
2. Seal oil low level	Float switch
3. Seal leakage	Pressure switch
4. Compressor vibration	Vibration pick-up
5. High compressor discharge pressure	Pressure switch
6. Low seal oil differential pressure	Differential pressure switch
7. Compressor discharge gas high temperature	Temperature switch

In a special set-up, various conditions, alarms, or shut-downs may be added.

Although exact figures are not yet available for publication, this new gas turbine product group at Cooper-Bessemer offers an impressively low initial cost of installation, which contributes most significantly to a projected low overall annual cost of operation. The product development of this concept in applying the lightweight, non-regenerative gas turbine in heavy duty industrial applications is definitely an interesting step in the continuing evolution of industrial type prime movers. Taking advantage of the weight and performance characteristics of the high output jet engine and combining this energy source with heavy duty, long life power turbine, installation packages and control systems produced from years of experience in industrial fields has given Cooper-Bessemer a new family of horsepower sources to be utilized where the economics of their application is dictated.

DESIGN FACTORS FOR GAS TURBINE FORGINGS

By C. R. BENSON*

GAS turbine engines which pump natural gas thousands of miles, provide emergency electrical power, move huge land and marine vehicles or, propel man through the air at high speeds are all designed for maximum reliable performance for each application. In so doing, the designer utilizes the maximum attainable from the available materials and processes. As a result, part integrity is an absolute essential demanding a high level of uniform metallurgical soundness available only in closed-die forgings.

Rotating parts such as turbine and compressor wheels, shafts and spacers are among the most critical parts of a gas turbine. In addition to possessing the necessary rupture, creep and tensile strength and ductility, they must also be able to withstand cyclic, thermal and mechanical stress loading. In short, they must have good fatigue strength for which fine grain size is a pre-requisite. In a closed-die forging, the coarse cast structure of the ingot, or billet, is refined, grain flow is developed in the required direction of greatest imposed stress and grain size is controlled. The resultant part, so formed by forging, has a uniform structure representing the optimum combination of all these properties.

In forging, quality control is exercised from the starting material to the finished product. Quality in the billet is determined by chemical analysis, macrostructure, microstructure, ultrasonic and mechanical testing. Additional quality is built into the part during forging by controlling forging temperatures, die design, rate of deformation and material flow. Furthermore, the quality of the finished product can be verified because the wrought structure produced by forging is now amenable to sensitive inspection techniques such as immersion ultra-sonic inspection. The same response to inspection was not possible in the starting coarse cast structure of the billet.

*Product Manager, Turbine Products, Wyman-Gordon Co., Worcester, Mass.

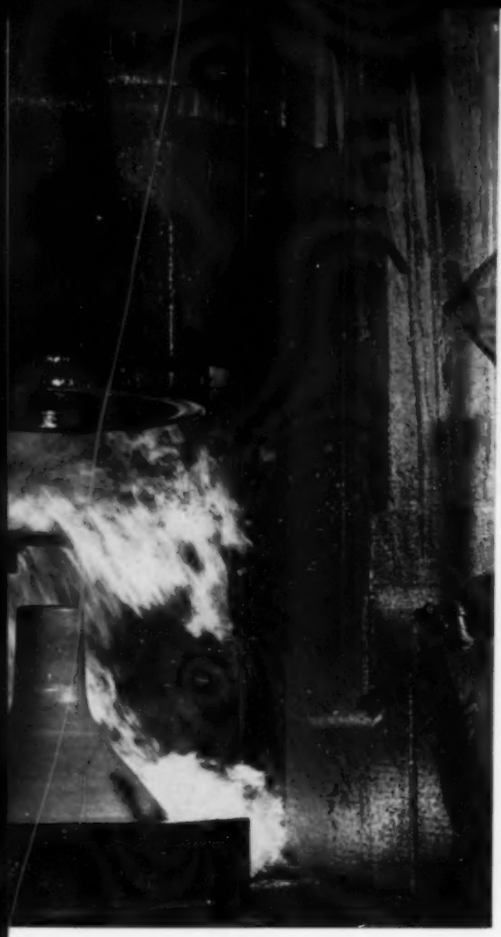
Gas turbine engine shaft being forged on a 20,000 lb. forging hammer at the Wyman-Gordon Worcester plant.

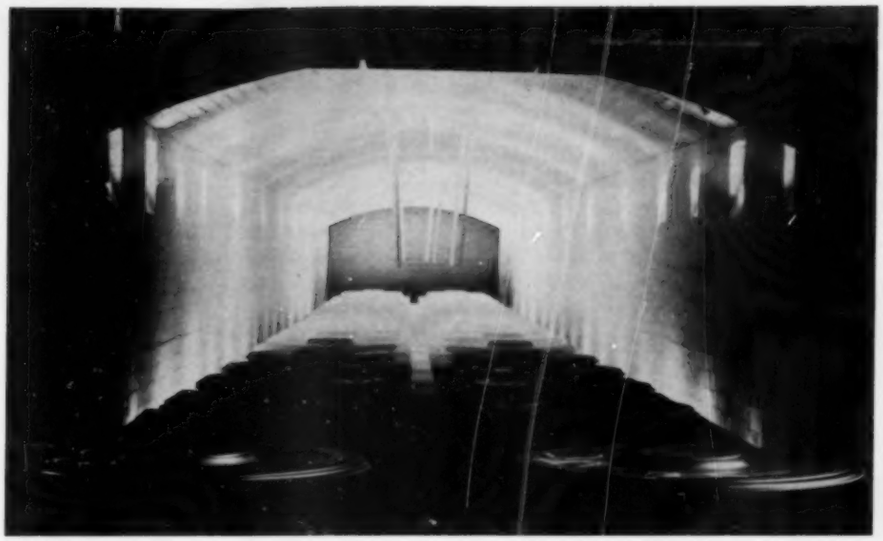
Although quality, reliability and uniformity of properties are among the most important factors to be considered in turbine component forgings, other considerations are necessary, particularly for commercial applications where long life and minimum maintenance are desirable. In this respect, the design engineer must consider:

1. Availability of long-time test data. The engineering data available on materials suitable for gas turbine applications consists primarily of short time tensile, creep and stress rupture properties. This condition exists because the military design criteria, for which most of the engineering data has been developed, required engine lives between overhauls of several hundred, or, at the outside, a few thousand hours of life. Consequently, the design engineer interested in engine life well in excess of military requirements, is faced with a problem of having to select his material applications on insufficient data. Yet, he nevertheless must still design to the maximum limits.

2. Cost. Cost is an important factor in the construction of any assembly. In a gas turbine engine, cost must be considered in relation to the quality and life expectancy of that engine. There can be a penalty for over-emphasis on initial cost of material and forming method.

First stage ring roll forged astroloy turbine spacer ring is handled from furnace by crew.





Jet engine compressor discs pass through heat treating furnace at Worchester plant.

3. Maintenance availability. Frequent maintenance surveillance is not to be expected for gas turbines operating in remote geographic.. areas on applications such as gas-line pumping or electrical power generation.

4. Requirement for instantaneous response in emergency situations. For all of the above-mentioned reasons, material failures cannot be tolerated. Once built, the gas turbine engine must perform without failure throughout its normal expected life. As a matter of fact, they do so perform and the reasons again lie in their careful and accurate design, in the initial selection of the right material and in closed-die forging of that material to achieve uniform reliable metallurgical properties.

Forging developments have kept pace with the ever-increasing military demands for higher strengths at elevated temperatures. In 1947, turbine inlet temperatures were in the neighborhood of 1,200° F. By 1955, the inlet temperature had advanced to 1,500° F. and in 1960, to 1,800° F. Similarly, turbine discs advanced from service temperatures of 800° F. to 1,400-1,500° F. Substantial development has been required to provide forgings from alloys capable of meeting the requirements of the military demands. The experience gained in the forging of such metals as high-strength, low alloy steels, stainless steels, titanium, iron base, high-temperature materials and nickel base alloys now is utilized on commercial gas turbines as well as advanced propulsion systems.

Forging technology and experience have pushed minimum mechanical properties closer to the maximum limits. Consequently, the designer today, can work to guaranteed minimum property levels, even in materials which only one or two years ago were not considered forgeable.

The ability to produce a shape is not the only criterion in producing a forging. The optimum properties in any configuration can only be developed by proper forging know-how. As the size of a forging increases, as work is performed with higher strength materials and as guaranteed properties come closer to the optimum, forging know-how takes on even greater importance.

The ability to produce a wide variety of sizes, shapes and configurations, particularly in the high strength-super alloys, requires wide range and versatility of equipment. Shapes and configurations can be produced on under-powered equipment, as related to the part, by repeated reheating, or over-heating. Such practice, however, does not result in optimum properties because rate and per cent of deformation must be controlled.

An end product which will achieve all the requirements demanded of it, is, of course, the goal and a goal which must be attained. Gas turbine engines, no matter what the application, must withstand extremes of temperature, high speeds, and extraordinary stress demands. This is as true in work-a-day turbines for commercial applications as in the most critical of military designs required for rockets, missiles and aircraft.

ALUMINUM

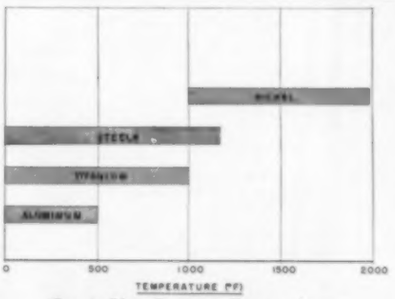
Aluminum and its alloys are used in temperature ranges up to 500°F. With low density and good strength-to-weight ratio, aluminum forgings are extesively used for compressor impeller wheels in radial flow turbines of up to 500-700 horsepower.

TITANIUM

Titanium and its alloys are used for compressor wheels, blades and other forged components in military and commercial aircraft gas turbines. Combining high-strength with low density, titanium is suitable for application of up to 1,000° F.

STEELS

Steels include low alloy, stainless and high nickel iron-base age hardenable alloys. The low alloy steels, because of low material cost, ease of fabrication and good mechanical properties, compose by far, the largest volume of turbine component forgings produced. Low alloy steels, because of their response to heat treatment, offer the designer a wide choice of properties for applications up to 800°-1,000° F. and the high nickel iron-base alloys up to 1,250° F. These materials, together with the low alloy steels are used as forged components in rotating and static parts including blades, wheels, spacers and structural members.



Gas turbine forging alloys, primary range of applications.

NICKEL-BASE ALLOYS

The nickel-base alloys are the ranking metals for use between 1,200° F. and 1,800° F. They develop their high temperature strength by age-hardening and are characterized by long-time creep-rupture strength and high ultimate and yield strength combined with good ductility. A majority of these alloys, initially developed for turbine bucket applications, are used in structural shapes, turbine wheels, shafts and spacers.

F-M To Sell Through Canadian Subsidiary

An agreement reached between The Canadian Fairbanks-Morse Co. Limited, of Montreal, and Fairbanks, Morse & Co., Chicago, returns to the American company the ownership and use in Canada of the Fairbanks, Morse name and trademarks, Thomas G. Lanphier, Jr., president of Fairbanks, Morse, announced. Canadian Fairbanks-Morse had for many years been the distributor in Canada of a number of product lines manufactured in Fairbanks, Morse & Co. plants in the United States. While there was no corporate connection between the two companies, members of the Morse family hold substantial financial interest in the Canadian company. Recently Canadian Fairbanks-Morse acquired its own scale and pump businesses. Canadian Fairbanks-Morse is taking the legal steps necessary to effect a change in its corporate name. The Canadian company will retain marketing rights for opposed-piston diesel engines manufactured by the American company in Beloit, Wis. Canadian Locomotive Company, a subsidiary of Fairbanks, Morse & Co. of Chicago with a minority interest publicly held by Canadian citizens, will now become the basic distributor in Canada of Fairbanks-Morse pumps, scales, and motor products and will market them in that country under the Fairbanks, Morse name. Canadian Locomotive is also preparing to expand its manufacture of Fairbanks, Morse products in Canada. It is expected that these actions will substantially increase the sales volume of Canadian Locomotive and enhance its ability to more efficiently serve the growing Canadian economy.

New LeT-W President

Lewis J. Burger has been named president of LeTourneau-Westinghouse Company, succeeding Merle R. Yontz. Formerly associated with General Electric in various management capacities, Burger came to Peoria from Ft. Wayne, Ind. He has served consecutively at General Electric as general manager of the Gear Motor and Transmission Components Department, Gas Turbine Department, Switchgear and Control Division, and Laboratory Operations of the Component Products Division. Yontz resigned the presidency of LeTourneau-Westinghouse which he has headed since it was formed in 1953, when Westinghouse Air Brake Company, Pittsburgh, bought it from R. G. LeTourneau, Inc. He has accepted a position with Caterpillar Tractor Co.

Controls Catalog

A new 60-page catalog, offering more complete information on Robertshaw-Fulton's all-pneumatic engine safety control system than has been previously available, is now available from Robertshaw's Fulton Sylphon Division. The new Catalog J contains full descriptions of a number of complete systems incorporating safety shutdown or warning upon malfunction of measured variables such as temperatures, pressures, levels, speed, vibration, etc. Individual components shuch as relays, indicators, receivers, etc., are also described fully. Copies may be obtained by writing direct to the Fulton Sylphon Division, Robertshaw-Fulton Controls Co., Box 400, Knoxville 1, Tenn.

ITS NEW

New Hydraulic System

A new hydraulic system for all blades used on the model C-6 tractor has just been announced by Euclid Division of General Motors, Hudson, Ohio and Gar Wood Industries of Wayne, Mich. Designed to meet the speed requirements of the Torqmatic Drive C-6, the new hydraulic package consists of a single cylinder and a variable volume piston pump known as the Gar Wood Variacs. The Variacs pump delivers oil only when needed for raising and lowering the blade . . . no oil circulates in the system in the hold position so there is no build-up of heat, thus insuring longer life and less loss of horsepower. When the blade load exceeds system capacity, the Variacs pump stops delivery of oil and automatically goes into hold position. In fixed volume systems, overload condition causes oil, under full pressure, to flow over relief in order to hold the blade, thus using engine horsepower needed for tractive effort, and creating heat. In addition to faster blade speed, lifting power of this new single cylinder design is up to seven tons greater than other dual cylinder dozer mountings because of greater mechanical advantage of the lever arm. Literature on the C-6 tractor is available from the Euclid Advertising Department, Hudson, Ohio. ITS NEW

Sales Representative

Richard Kachelmeyer has been appointed a sales representative for the Western region of American Bosch Arma Corporation's Commercial Sales Division. Mr. Kachelmeyer has been connected with the marketing and service phases of automotive equipment for more than ten years including the carrying on of extensive training activities in both fields. He came to American Bosch from Stewart Warner's South Wind Division where he was a Field Sales and Service Representative for the past three years.

Purolator Staff Engineers

Appointment of Charles J. Casaleggi and Theodore C. Sauer as staff engineers for Purolator Products, Inc., has been announced today by Jules P. Kovacs, vice president and director of engineering. Complete responsibility for product design and laboratory test engineering has been assigned respectively to Mr. Casaleggi and Mr. Sauer.

Mid-West Diesel News

By L. H. Houck

GALLAGHER & Phillips, Chicago, a Caterpillar 977, a 955H and a 933F, added to its fleet for excavation work, from Patten Tractor & Equipment Co., Bellwood and Rockford, Ill., and Hammond, Ind.

MISSOURI-Illinois Tractor & Equipment Co., St. Louis, Charleston, Mo., and Quincy, Ill., is displaying International BIG stuff—27 yd. Paywagon and the 34 yd. 295 Payscraper, and the new 817 crawler.

NEW—the Tree Eater, distributed by Rogers Equipment Co., Little Rock, hydraulic unit powered with a 325 hp GM V-8 diesel, mounts on a Case 800 diesel tractor. It can clear 12 acres of 10 to 12 year-old regrowth in 8 hours. Machine travels over felled trees, making mulch, or ready for plow or disc.

DROTT Tractor Co., Milwaukee, has delivered an Allis-Chalmers 16000 diesel-electric generator set to Polk County to power an agricultural lime crushing plant near Nye, Wis.

W. A. Schemmer Limestone Quarry, Inc., Logan, Ia., two Euclid TS-24 scrapers are used for stripping and three R-10 rear dump Euclids make up hauling units.

WESTERN Contracting Co., purchased 14 37-M 30-ton Marion cranes, with 3-71 GM diesels, Twin-Disc clutches, and six 93-M Marions with Cummins NHS61 diesel, Twin Disc torque converters for use on USAF ICBM sites near Lincoln, Neb.

DROTT Tractor Co., Milwaukee, an Allis-Chalmers 21000 generator set to Polk County, Wis., for powering a portable blacktop plant.

OBSERVED: Two Manitowoc 4000 cranes with International diesels, 140 and 110 ft. booms, used for stripping high forms on Dardnelle spillway in Arkansas. Contractors Al Johnson, Minneapolis and Peter Kiewitt, Omaha, Guy H. James, Oklahoma City. Estimated job cost $94½ million.

FRUIN-Colnon-Utah recently added a third Eimco tractor for tunnel work on its Union Electric job—diesel is Cummins.

D. D. Kennedy, Inc., A-C dealers for northern Illinois and northern Indiana, report high interest and increased sales of the new Allis-Chalmers TL-30, 184 hp turbo-charged A-C diesel, handles 10,500 lb. loads in front loader bucket.

WESTERN Engine Co., has moved to a new location—2625 W. 16th St., Broadview, Ill., with a new building for GM diesel sales and service.

NEW from Ingersoll-Rand, 12 cfm portable air compressor, with cycloidal compression, driven by a single diesel, a GM 12V-71 diesel. Mid-West dealers include Missouri-Illinois Tractor Co., Hazelwood, Mo., Quincy, Ill., and Charleston, Mo.

RACINE County, Wis., a 21000 Allis-Chalmers power unit for operating a crushing plant from Drott Tractor Co., Inc., Milwaukee.

NEW unit on U. S. 90 job in Mississippi of J. A. Hadley Const. Co., Humboldt, Tenn., is a Tempco vibratory compactor pulled by an Internal. 650 diesel tractor on rubber.

W. E. Blain & Son, contractors, Mt. Olive, Miss., is using a Seaman Pulvi-Mixer, with GM diesel, on lime stabilizing sub-base treatment on Interstate 55 and a Pettibone-Wood Speed mixer with a GM diesel.

West Coast News

By James Joseph

AS auxiliary power aboard the *Valerie*, 55 ft. cruiser owned by Wade Olsen, San Diego, a Yanmar 3½ kw AC generator set. The Yanmar diesel is remotely controlled. Sale by Anderson-O'Brien Co., San Pedro.

FOR Montgomery Ward's Mission Valley Shopping Center new store, San Diego, a GM 2-71, 30 kw emergency standby diesel electric set. New store, air conditioned and windowless, buys customer insurance—with its standby diesel.

FOR the *Valiant Lady*, 28 ft. Steelcraft yacht owned by Lloyd Perry, a four cylinder 68 hp Osco Ford marine diesel, installed by Wilmington, Calif.'s Fellows and Stewart, Inc.

INSTALLED: a GM 12V-71, 335 hp at 1800 rpm diesel, repowering the *Sea Master*, a seiner, owned by Joe Lauro and Mercury Fishing Co., San Pedro, Calif.

DELIVERED: to Westly Palms Development for senior citizens, San Diego, a 60 kw GM 6-71 emergency diesel-electric standby. Sale by Anderson-O'Brien Co.

SOLD: to Pierpoint Sportfishing Co., Long Beach, Calif., for their new 85 ft. sportsfishing fleet, four 4-cylinder 68 hp Osco Ford marine diesel generator sets with Palmer 30 kw at 1800 rpm generators. Sale by Fellows and Stewart Inc.

INSTALLED aboard Raul Dumas' 54 ft. motor sailing vessel *Al-Ray*, a 3½ kw Yanmar diesel generator set, 8 hp at 2000 rpm, horizontal cylindered. Boat operates off Southern California.

DELIVERED: to Essick Mfg. Co., Los Angeles, 20 Deutz F4L 712s (40 hp at 1800 rpm), for use on road-building vibration-compaction equipment. Sale by Diesel Energy Corp.

TO Hartnell Construction Co., Long Beach, a Thew Lorain shovel powered by a Cummins NTO-6, 262 hp at 2100 rpm. Sale by Cummins Service and Sales, Los Angeles.

BELL, Calif.'s Stang Corp., has taken delivery of a number of Deutz 2-cylinder F2L 712s (18 hp at 1800 rpm) for powering dewatering pumps, designed for mining and sump operations.

WESTERN Offshore Drilling Co.'s offshore Goleta, Calif. operation has installed three Caterpillar D397 400 kw electric sets, rated 650 hp at 1300 rpm. Sale by Shepherd Machinery Co., Whittier, Calif.

DELIVERED: to W. J. Foster construction company, Westminster, Calif. a Galion road grader Cummins-powered by an H-6-BI, 160 hp at 1800 rpm diesel engine.

TO Atlas Copco Corp., San Carlos, Calif., more than 200 Deutz engines—F4L 514s, F2L 514s and F6L 514s—for powering portable air compressors of various capacities. Sale by Diesel Energy Corp.

OWL Truck And Construction Co., Compton, Calif., has taken delivery of an American Crane with Cummins NHC-4, naturally aspirated 130 hp at 2000 rpm diesel.

TO Phoenix Auto Supply Co., Phoenix, Arizona, an F12L 714 Deutz, 200 hp at 1500 rpm, for powering deep-well and mining machinery.

AT work on a Healy Tibbitts Construction Co. barge, off Santa Barbara, Calif., a Lister-Blackstone HA-2 (10 kw

generator set), powering radio and electric lights.

FOR the 83 ft. fishing boat *St. George II*, owned by San Pedro's Tony Pisano, a Lister-Blackstone SL-1 (4½ hp at 1800 rpm) as auxiliary standby diesel generator. Sale by Bolstad Sales & Service, San Pedro.

ANOTHER Lister-Blackstone, this a 2L-2, 8½ hp at 1800 rpm, as auxiliary generator aboard the yacht *Tierra*, operating from California Yacht Anchorage, San Pedro, Calif.

DELIVERED: six prototype compressor-powering American Marc AC-2 two-speed diesels (1200 and 1800 rpm) to drive Trane compressors for mechanical railroad reefer car refrigeration—the new combines located *under* car, not as previously in end sections.

DESTINED as standby diesel generators for Titan missile installations: American Marc's AC-1 (1800 rpm, 7½-hp), a number already delivered to the Corps of Engineers, U. S. Army.

Promotions Announced

F. C. Schulze, Waukesha Motor Co. vice president of sales, has announced appointment of Robert A. D'Amour as manager of manufacturer sales, and Roland R. Heideman as manager of distributor sales. Mr. D'Amour joined the Motor Company in 1952, after serving as sales engineer and assistant regional sales manager for the Cummins Engine Co., where he had been employed after his graduation from the Michigan College of Mining and Technology. He was appointed assistant sales manager in January, 1960. Mr. Heideman joined the Service Division of the company in 1934. In 1949 he was transferred to the Sales Division of the company's California branch where he worked with West Coast distributors and engine-driven equipment manufacturers as sales engineer, and in later years, as assistant branch manager.

57 Unit Contract

The White Diesel Engine Division of The White Motor Co. has been awarded a $2,408,658 contract by the U. S. Corps of Engineers for 57 engine-generator sets to be used as standby power in the Titan II missile program. The contract also includes an option for the purchase of 23 additional sets at a later date. Engines involved are the supercharged, six-cylinder Superior Model 40-SX-6's, rated 510 bhp at 900 rpm and 125.5 bmep, with 8½" bore and 10½" stroke. They will be driving 350 kw generators. These sets will be shipped in varying quantities to a number of strategic sites.

Standby Set Course

Installation, operation and maintenance of standby diesel electric sets are subjects covered in a specialized training course now being offered to telephone company employees by the Detroit Diesel Engine Division of General Motors. The course, prepared in collaboration with the Western Electric Company, is an addition to Detroit Diesel's regular service training program and is offered at the Division's Product Service Training School in Detroit. Covered are all features of the Division's Series 71 diesel engine including design, disassembly and assembly, trouble-shooting and tune up procedures. A partial list of other subjects covered includes generator design and construction, generator trouble shooting, voltage regulation, automatic starting and shut-down, and parallel operation. Duration of the complete course is two weeks with classes limited to 12 trainees to permit maximum participation in laboratory sessions. Details on the course can be obtained by writing the Detroit Diesel Engine Division, Service Training School, 13400 W. Outer Dr., Detroit 28, Mich.

Waukesha Sales V.P.

F. C. Schulze

F. C. Schulze has been advanced to the post of vice president of sales for the Waukesha Motor Co. Mr. Schulze had held the position of general sales manager since 1949. He will direct and coordinate the motor company's sales efforts throughout the country and in foreign markets. He has many years of experience in the sale and application of internal combustion engines and related products, and has a wide acquaintanship with engine-powered equipment manufacturers, and the owners and users of such equipment. Mr. Schulze joined the Waukesha Motor Company in 1928. He was named assistant sales manager in 1938 and general sales manager in 1949.

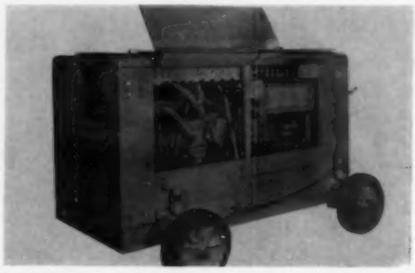
New UBL Towboats

The most powerful river towboat ever launched in the Pittsburgh area and one of the most powerful afloat splashed into the Ohio River. The 6400-horsepower vessel—to be known as the *Mariner*—slid down the ways at the Neville Island shipyard of Dravo Corp. She will enter common and contract carrier service for Union Barge Line Corporation, Pittsburgh, about August 1.

A sister towboat, the *Navigator*, was launched early in July and will begin moving tows about September 1. Both craft will operate primarily on the Mississippi River between St. Louis and New Orleans. Both vessels are 192 ft. long, 52 ft. wide and 12 ft. 6 in. deep from main deck level to the bottom of the hull. Twin 12-cylinder Nordberg diesel engines rated 3200 hp each will power each of the new boats.

New Air-Cooled Compressor

A new six cylinder, five stage, high pressure compressor is being marketed by Ingersoll-Rand Co. This new compressor, model 6R80, has an actual delivery of 80 cu. ft. at 6000 psig at 1300 rpm and is available as a bare unit, baseplate mounted or portable mounted. This is an air-cooled reciprocating type unit of radial design with all cylinders in a vertical plane. All cooling is accomplished by a 26 inch diameter, 6 bladed steel fan mounted on the end of the compressor crankshaft opposite the drive end. Air is drawn over the compressor and also forced over the intercoolers and aftercooler. Intercoolers and aftercooler incorporate moisture drain traps. For further information, write to Ingersoll-Rand Co., Compressor Engineering Dept., 11 Broadway, New York 4, N.Y.



ITS NEW

Nordberg Representative

R. M. Pearson

Appointment of Robert M. (Bob) Pearson as a special representative in the Great Lakes District was announced by R. W. Bayerlein, vice president, Engine Division, Nordberg Mfg. Co. Mr. Pearson will headquarter in Pittsburgh, Pa. and cover special assignments out of Nordberg's Cleveland office. With a background of 35 years in the industry, he has a wide range of experience in the application of diesel engines for marine, municipal and industrial installations. He recently held the office of chairman of the Market Development Committee of the Diesel Engine Manufacturer's Association.

F-M International Sales Manager

C. W. Batkay

Appointment of Carl W. Batkay as sales manager, International Division, Fairbanks, Morse & Co. at Fair Lawn, N. J., has been announced by George E. Millar, general manager. Batkay, a veteran of 20 years with the International Division, advances from assistant sales manager. Previously he had been a Latin American area manager for all products and before that handled export diesel engine sales.

Low Cost Injector Tester

A simplified, lower cost injector tester to check nozzle pressure settings has been introduced by Leslie Hartridge Ltd. The Nozzle Poptest utilizes a hand-operated hydraulic system with a self-priming pump which provides instant fuel delivery at any position of the operating lever. A pressure gauge, graduated from 0-400 ats. and 0-5900 lbs. psi, is protected from extreme pressures by a patented, cut-off valve that operates with finger-tip tightening. The valve's self-centering feature eliminates needle and seat wear. Quick-grip injector connectors, utilizing replaceable "O" oil seal rings, can be supplied for all standard type injectors used on diesel truck, tractor, railroad, marine and industrial engines.

The Hartridge Poptest can be easily removed from the workshop and installed in a service truck for field work without draining and re-filling. The unit comes complete with connectors for "S" and "R" injectors of standard thread and cone size. Included is a seventeen page instruction book on nozzle servicing, and injector fault-finding chart, and a listing of nozzle pressure settings for over 700 diesel engines. Complete details can be obtained from Diesel Injection Sales & Service, Inc., 1120 E. Brambleton Ave., Norfolk, Va., exclusive distributor in the United States for Hartridge equipment. (ITS NEW)

AVAILABLE NOW! The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 9110 Sunset Blvd., Los Angeles 46, Calif.

Coupling Manager

J. E. Meyers

John E. Meyers has been appointed manager of the Coupling Department, Koppers Company, Inc., Baltimore, Md. He has been marketing manager of the company's Sound Control Department. Mr. Meyers joined Koppers in 1941 as junior engineer. From 1949-1960, he was district sales manager of the Pittsburgh district before returning to Baltimore to accept the marketing position.

Distributor Advisory Committee

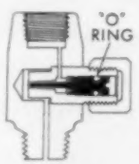
To promote more efficient field service for Roosa Master fuel injection equipment manufactured by the Hartford Machine Screw Co., a Distributor Advisory Committee has recently been formed to meet annually at Hartford. Its membership is comprised of the four leading central distributors of North America. Participating at the first meeting were S. E. Franklin of Diesel Control Corporation, Wilmington, California, T. S. McGlynn of McGlynn Diesel Service, Inc., Flushing, N. Y., and G. H. Roost of Joseph Lucas Ltd., Toronto, Canada. The fourth member, is A. Christlieb of Sociedad Electro Mechanica, Mexico City, Mexico. James J. Ford, general manager of Hartford's Fuel Injection Division, is chairman of the committee and J. N. Britton, service manager, is also a permanent member. It will be the principal aim of the Advisory Committee to develop a long-range program designed to strengthen the entire service organization for Roosa Master fuel injection equipment. There are about 80 Roosa Master Central Distributors and 300 Authorized Service Stations throughout the world. At the Annual Meeting The Hartford Machine Screw Co. presented a special plaque to S. E. Franklin in recognition of the highest volume of sales on Roosa Master products achieved in 1960. Mr. Franklin was recently elected President of the Association of Diesel Specialists, Inc. of America.

Left to right, James Ford, S. E. Franklin, James Britton.

A-C Engineering Manager

Douglas W. Erskine has been appointed manager of Engine Engineering at the Harvey (Ill.) Works of the Allis-Chalmers Mfg. Co., succeeding A. F. Ochtman, who retires July 1. Erskine comes to Harvey from the company's Springfield Works where he had been Executive Assistant Chief Engineer since 1957. He now will be responsible for the design, development and production engineering of the diesel, natural gas, butane and gasoline engines manufactured at Harvey Works. Erskine has been with Allis-Chalmers since 1935, when he joined the Company's graduate training course. He was assigned to Springfield Engineering as draftsman on crawler tractors on completing his training. Later he was named Design and Project Engineer on crawler tractors and military vehicles. In 1948 he was appointed Assistant Chief Engineer, supervising design of tractors and purchase of experimental materials for tractors and motor graders.

Gauge Pulse Dampener



Sectional view of pulse dampener

Now available in stainless steel or rolled brass construction, new, low cost, pulsation dampeners for pressure gauges are announced by Kunkle Valve Co. for use on pumps, compressors and other pulsation producing, air, gas or liquid-handling O.E.M. or inplant equipment within a limit of 10,000 p.s.i. operating pressure. Claimed to effectively smooth out pulsation and reduce gauge flutter, the dampeners guard against excessive wear or destruction of gauge mechanisms, and maintain calibration accuracy. The variable orifice may be externally adjusted without line or gauge disconnection. The hex cap protects adjustment against inadvertent change. An "O"-ring protects against leakage. A specification sheet is available on request from the manufacturer, Kunkle Valve Co., Fort Wayne, Ind.

ITS NEW

Exhaust Stack Protector

Expensive engine repairs caused by rain flooded pistons, cracked cylinder heads and warped valves can be virtually eliminated by the use of a Weathercap on vertical exhaust stacks. The weathercap prevents rain, snow, dust and insects from entering the exhaust stack and causing damage. This protection becomes increasingly important as tractors, trucks and other gasoline or diesel powered vehicles or pieces of equipment are put into heavy summertime usage. The counterbalanced cap is closed when engine is not running, but at the first sign of stack pressure, the cap opens to permit exhaust to escape. Vertical stack equipment for which Weathercaps are available, and advisable, include tractors, trucks, sand pumps, pavers, compressors, mixers, generators, stationary engines, etc. Additional information may be obtained from Anthes Division, Gleason Corp., 325 N. Plankinton Ave., Milwaukee 3, Wis.

ITS NEW

Catamaran For The Army

The U. S. Corps of Engineers has ordered a revolutionary new type of survey vessel, a 45 ft. aluminum, water-jet propelled catamaran. It is scheduled to operate in the Great Lakes this summer. The firm of MacLear & Harris, New York City naval architects designed the craft. The aim of the design is to provide a large and stable working platform which can be taken into very shallow water for inshore soundings for chart and map making. The craft was designed to take a pair of Gray 674 HNS diesels which the Army Engineers had in their possession. The 360° rotatable underwater jets will be the Hydro-jet marine units capable of delivering 2,000 lbs.

of thrust. Both jets will rotate in phase or 180° out of phase when one is used for backing. Aside from this they will not be able to rotate independently of each other. The centrifugal turbines are of the fire-fighting variety. The water intake is located aft of the jet so that any flotsom or rocks that may be drawn to the intake grating can be knocked off by the jet stream.

Mr. Julius Grigore, Jr., of the U. S. Army Engineers, Detroit District, who is the Government Project Engineer and both Frank MacLear and Robert Harris of the N. Y. naval architectural firm are convinced that many more catamarans will be built in the future, as both workboats, yachts, personnel carriers, and possibly military craft. The major advantages of the catamaran configuration is that the twin hulled boats are much less likely to broach in following seas, less likely to pound in head seas, and therefore need not cut back on their throttles as soon as single hulled vessels in rough water. They are tremendously stable and do not get into cumulative rolling as do single hulled boats. They also provide a far larger deck area for their length. The gain in living and working accommodations is 25%, compared to single hulled vessels of the same length.

Dravo Pioneer on New Assignment

After establishing an enviable record in ship docking and harbor performance in New York Harbor, the *Dravo Pioneer* now is assigned to towing oil barges in the Philadelphia and Chesapeake Bay areas and in the limited coastwise service. The 1600 hp vessel, first tugboat ever equipped with a Kort nozzle and steering system of the type utilized on the most modern inland river towboats, has been chartered by Interstate Oil Transport Co., of Philadelphia. Designed by Dravo Corp., Pitts-

The *Dravo Pioneer* is now towing oil barges in the Philadelphia and Chesapeake Bay areas under charter to Interstate Oil Transport Company, Philadelphia. First tugboat ever equipped with a Kort nozzle and backing as well as steering rudders, the *Pioneer* was built at the Wilmington, Delaware yard of Dravo Corporation.

burgh, the *Pioneer* recently completed a six-month charter to Dalzell Towing Co., of New York. In addition to the Kort nozzle and drastically different stern hull lines, the *Pioneer* has three rudders, one for steering ahead and two—mounted forward of the propeller—for 100 per cent astern steering control. However, she is not destined to remain unique for long. Two similar tugs are nearing completion at Dravo's Wilmington shipyard. The new boats will be 101 ft. long, 27 ft. wide and 14 ft. 6 in. deep, with an operating draft of 12 ft. Each will be powered by a 1600 hp General Motors marine diesel engine, equipped with Western reverse-reduction gears and Wichita clutch with controlled slip features.

Captain Frisky, a newly launched DESCO shrimp trawler, makes 12 knots on her trial run outside of St. Augustine, Florida.

DESCO'S 900th VESSEL IS 68 FT. *CAPTAIN FRISKY*

By ED DENNIS

IN late May, another milestone was added to the record of Diesel Engine Sales Co., St. Augustine, Fla., as the Cat powered *Captain Frisky* was christened and launched at the shipyard on the banks of the San Sebastian River. This was the 900th vessel built by DESCO. Indicative of the fast pace being set by this company is the fact that the launching of hull No. 800, the 72 ft. *Lady Kossie* for Estero Shrimp Co., was reported in the November 1958 issue of this magazine. Important too, of the last 100 boats, 91 of them have been Caterpillar powered.

The *Captain Frisky* was delivered to the Seagarden Corp. of Brownsville, Texas. Mr. Will Hardee, president and owner, is well known in the fishing industry having served the shrimp industry in many ways such as vice chairman, National Shrimp Congress; director of Shrimp Association of The Americas, the Texas Shrimp Association, Brownsville Shrimp Association, the National Fisheries Institute, Gulf and Caribbean Fisheries Institute and is on the Fisheries Advisory Committee of the U. S. State Department.

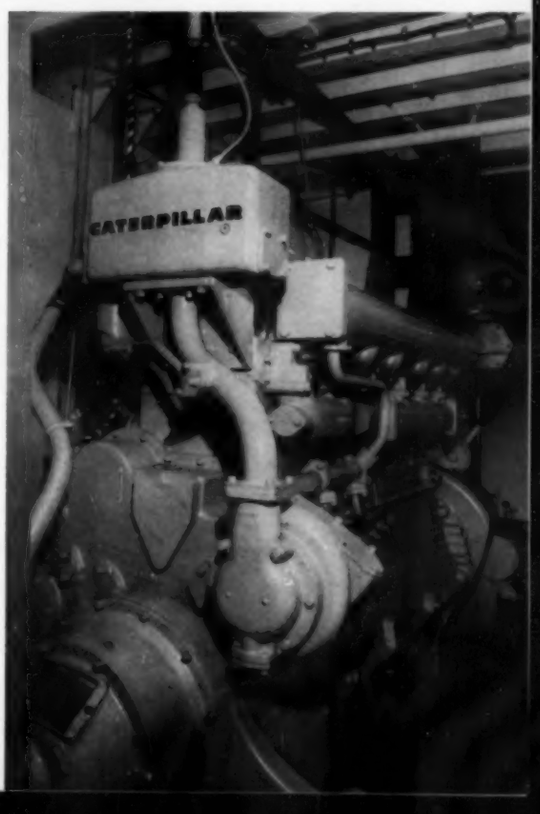
This new vessel is typical of the standard DESCO dieselized 68 footers. Designed by Tams, Inc., it has an 18½ ft. beam and a 6½ ft. draft and can readily boast of the speed and seaworthiness necessary to work the Campeche shrimp beds or any of today's far-flung fishing areas. Propulsion power for the *Captain Frisky* is provided by a model D342 series C naturally aspirated Caterpillar marine diesel engine having a continuous horsepower rating of 170 at 1225 rpm and a maximum rating of 200 hp at 1300 rmp. This six cylinder, four-cycle diesel engine has a piston displacement of 1246 cu. in. Power is delivered to the four bladed 50 x 34 Federal propeller through a Twin Disc 3:1 reverse and reduction gear and a 3 in. bronze propeller shaft. A Twin Disc front power take-off is used to operate such auxiliary equipment as a Stroudsburg hoist. Both the stern bearing and stuffing box are of 3 in. bronze. For engine cooling, a keel cooler is used. There are seven fuel oil tanks with a capacity of 7200 gals. plus tanks for 800 gals. of fresh water and a 55 gal. lube oil tank.

Before World War II, the shrimping business caused hardly a ripple in our nation's economy. Today shrimping is our number one fishing industry. The phenomenal growth of the shrimping industry can be largely credited to two things; the invention of the otter trawl net and the use of diesel engines for propulsion. Both enabled shrimpers to use larger boats and to seek the shrimp off-shore in deeper water. According to the Florida State Chamber of Commerce, Florida's catch of shell fish totaled 81,973,000 lbs. in 1960 which was 20% over 1959.

L. C. Ringhaver, DESCO president, has been honored by the United States Government and several foreign governments for his outstanding knowledge in his profession, "the building of dieselized shrimp trawlers". In short, Ringhaver and his crew know the shrimp and diesel trade.

Author's Note

The #900 launching was the first launching missed by George W. Codrington, who passed away less than a month before this event. Mr. Codrington, a retired vice president of General Motors and general manager of Cleveland Diesel Engine Div., obtained the shipyard shortly after World War II and chose L. C. Ringhaver, a GM cost accountant, to put the then struggling yard on a paying basis. It was a policy of Codrington to help diesel minded men in their profession and, in fact, in June 1936 gave this author a job at the old Winton plant in Cleveland.



The engine room on the *Captain Frisky* showing the D342-C Caterpillar marine diesel. Engine drives through Twin Disc 3:1 r&r gear and shown in foreground is Twin Disc pto for auxiliary equipment drive.

Gulf Coast Diesel Notes

By Elton Sterrett

ANADARKO Public Works, Anadarko, Okla., has equipped its municipal power plant with three Chicago Pneumatic model 862DF-CT diesel dual fuel engines driving Allis-Chalmers 1350 kw, 4160 v, 3-phase, 60 cycle ac generator sets. The station, including building, was a turnkey job by Stewart & Stevenson Services, Inc., of Houston.

JARDINE Waugh, Ltd., Singapore, Malaya, has taken delivery of two General Motors vertically mounted 8V-71 diesel engines equipped with integrally mounted reduction gears for driving centrifugal slurry pumps in tin mines. The engines were equipped and shipped by Stewart & Stevenson Services, Inc., Houston

KACY Manufacturing Co., Houston, has bought six Allis Chalmers model D-344 4-cylinder, 344 cu. in. diesels from Applied Power Equipment & Manufacturing Co., of Houston. The engines will be connected to Gardner-Denver Centrifugal pumps for pipeline testing.

PETROLEOS Mexicanos, Mexico, D.F., has taken delivery of two Stewart & Stevenson model 2-GD-15C 15 kw ac generating sets, each powered by a GM 2-71 diesel.

W. C. Fatjo Drilling Co., Lafayette, La., is powering one of its deep oilwell drilling rigs with diesels furnished by Waukesha Sales & Service, Inc., of Houston. The engines include one model LRDBCU, one NKDBU, two WAKDBU, one 135DKU, two 180DLCU and two model 135DKBSU, each of the last pair being connected to a 50 kw 1200 rpm generator.

D. B. Boat Rentals, New Iberia, La., is repowering one of its craft with a GM model 8V-71, marine propulsion diesel, furnished by Stewart & Stevenson Services, Inc., of Houston.

THE Western Co., Fort Worth, Tex., is replacing a gasoline engine in one of its trucks with a General Motors 6V-53 diesel, adapted for this service by Stewart & Stevenson Services, Inc., of Houston.

PONA Engineers, Inc., of Houston, will drive two Ingersoll-Rand compressors with a pair of Caterpillar model G342 turbocharged and after-cooled engines rated 235 hp at 1000 rpm. The engines were supplied by Zagst, Inc., of Houston.

CABOT Corporation, Odessa, Tex., has taken delivery of a model 6-110 General Motors open type diesel from Stewart & Stevenson Services, Inc., of Houston.

STANDARD Vacuum Oil Co., Karachi, Pakistan, has ordered from Stewart & Stevenson Services, Inc., of Houston, one closed type General Motors diesel power unit, model 3-53.

PENROD Drilling Co., through Gardner-Denver Company who built the rig, has had it equipped with three Waukesha model VLRDBSU, two model 135DKU, and two model WAKDU Waukesha diesels, the latter pair driving 100 kw 1200 rpm generator sets. The engines were supplied by Waukesha Sales & Service, Inc., of Houston.

BREWSTER Co., Shreveport, La., is powering a new oilwell drilling rig with one model VLRDBSU, two model WAKDBSU, three model 180DLCU and three model 135DKU Waukesha diesels, furnished by Waukesha Sales & Service, Inc., of Houston.

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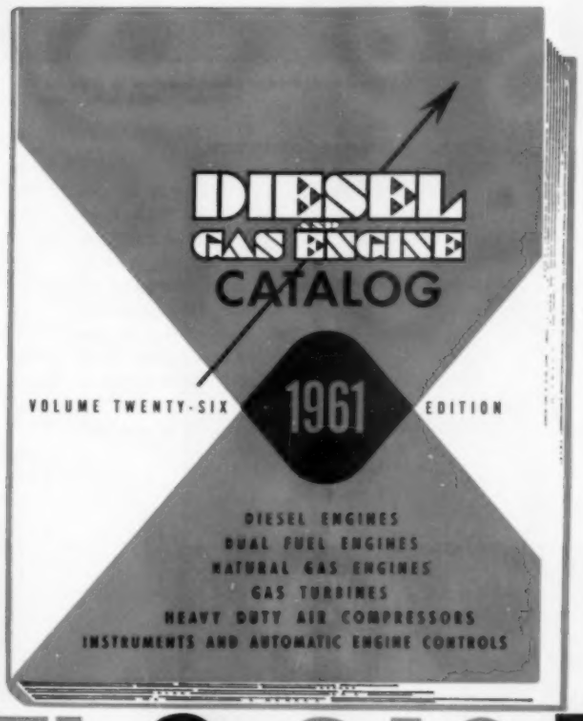

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7. GAS TURBINES—This section is devoted to the gas turbines currently on the market, both in this country and abroad.

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NAME POSITION

COMPANY

BUSINESS CLASSIFICATION

ADDRESS

CITY ZONE STATE

The 16 in. dredge pump installed in the portable dredge, *Sandstorm*, is driven by a 12-cylinder, model 567C General Motors diesel engine.

Portable Dredge *Sandstorm*

A dredge built in Florida, transported by rail, and assembled on the bank of the Platte River near Grand Island, Neb., is playing an important role in the highway program of the State of Nebraska. The dredge, *Sandstorm*, designed and built by the American Machine and Engineering Co., Pompano Beach, Fla., is reported to be one of the largest completely portable dredges to be built. The entire unit can be transported to the dredging site by ship, rail or truck. The *Sandstorm* is owned and operated by the Missouri Valley Construction Company. This company has the contract for building the Grand Island Interchange for Interstate Route 80. The dredge is working in an area which will become a forty-acre lake. The lake will be dug to an average depth of eighteen feet and when completed will be a recreation area. On this project, the *Sandstorm* will pump the dredged material a distance of four-thousand feet to make the fill for the interchange. It is estimated that one-million cubic yards of material will be moved in less than four months. The dredge is 65 ft. overall, 24 ft. wide and 6 ft. deep. Heart of the dredge is the 16-inch dredge pump. This pump is driven by a General Motors 12 cylinder model 567C diesel engine rated at 1230 hp. The engine is connected to the pump through a 1.69:1 ratio reduction gear equipped with a pneumatic disconnect clutch. The control for the pumping unit is in the engine room. Power for the spuds, cutter head and swing gear is supplied by a GM model 6-71 diesel generator unit, rated 125 kw, 240 v, ac. The cutter ladder can reach a depth of 33 ft. The cutter head is driven by a 50-hp motor and the swing gear by a 20-hp motor.

The 12-cylinder, model 567C General Motors diesel engine on the portable dredge, *Sandstorm*, rated at 1230 hp, with reduction gear and coupling for driving a 16 in. dredge pump.

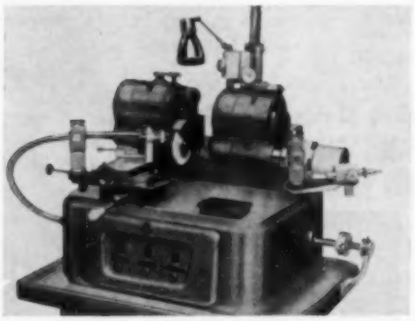
Heads DCA Unit

C. L. Allen

Dynamics Corporation of America announced that Charles L. Allen, for the past five years assistant to the president of DCA, has been elected president of International Fermont Machinery Co., recently-acquired DCA subsidiary. Fermont, with plant at Ramapo, N.Y., is a manufacturer of diesel- and gasoline-fueled electric power generator plants, ground support and heavy-duty airport maintenance equipment and other machinery products. Its engine-driven generator sets, ranging in power from 1,000 to 350,000 watts, are widely used in military communications, radar and other systems, as well as in industrial and commercial applications. Mr. Allen had been Vice President and General Manager of the Slater Electric and Manufacturing Co., General Sales Manager of the Sessions Clock Co., and Industrial Sales Engineer at General Electric.

High Precision Optical Grinder

The Elgin Triscop high precision optical grinding machine for sub-miniature internal, external grinding and lapping work, originally developed for the diesel field to regrind injectors for marine and heavy duty diesel engines; contains design improvements so that it also provides for electronic, aviation, instrument and the miniature fields, grinding to RMS finishes. Built-in optical



goniometers provide exact readings of minimum angular displacement to fractions of degrees, also to minimum seconds. After grinding the parts can be checked using the built-in special checking microscope. Accessories are included to provide for wheel truing to micrometric accuracy, needle grinding to .0000" concentricity, collets for various sizes and diamond truing device. For more information write S & S Machinery Co., of 140 53rd St., Brooklyn 32, N.Y.

Aluminum Charter Boat

Powered by two model 6-71 General Motors diesel engines and with 1.5:1 reduction gears and using 24 in. propellers with 26 degree pitch, the *Mary Bob*, a 48 ft. all-welded aluminum sports fishing charter boat has gone into operation at Warrenton, Ore. Built by Leo M. Jansen of the Jansen Machine Shop at Gresham, Ore., the *Mary Bob* was designed to be used between salmon runs as a crab fishing boat in Pacific Northwest waters. Operating as a salmon charter boat, the *Mary Bob* is currently licensed to carry 20 passengers but is qualified to carry 33 with a crew of two. Accommodations for six crewmen are provided when used fishing for crab. The vessel has a beam of 12 ft. 3 inches and draft of 32 in. Freeboard at the bow is 6 ft. and cruising speed is 20 knots.

OGP Committee Member

J. T. Adams

Appointment of Joseph T. Adams to the Executive Committee of the Oil and Gas Power Division of The American Society of Mechanical Engineers was recently announced by William H. Byrne, ASME president. Formerly an associate to the Executive Committee, Mr. Adams will serve in his new capacity for a 5-year term. Mid-Western District Manager for Nordberg Mfg. Co., Joe Adams has been active in ASME-OGP for many years.

Michigan-Ohio News

By **Jim Brown**

CYRIL J. Burke Inc. of Detroit sold a Del Mag diesel D-12 hammer to A. I. Williams Construction Co. of Southfield, Mich. The new Del Mag will be used on bridge construction and expressway work.

STEVE Klochko of Dearborn, Mich. has accepted delivery on an International TD-9 crawler with Drott 4-In-1 attachment. Sale was made by Wolverine Tractor & Equipment Co. of Detroit and Grand Rapids.

R. S. and S. Fisheries of Oscoda, Mich. recently repowered the gill-netter fish boat *Palmer* with a Cummins HR-6-M engine (175 bhp) using Twin Disc MG-165 reduction gear and front power takeoff. The Cummins distributor is Cummins Diesel Michigan Inc. of Dearborn, Mich.

CONSUMERS Power Co. of Royal Oak, Michigan recently accepted delivery on a John Deere Model 1010 crawler (8,000 lb.). The new 'dozer will be used in pipeline construction and is equipped with an all hydraulic dozer blade and powered by John Deere's 4-cylinder diesel engine (40 hp). John Deere distributor is the R. G. Moeller Co. of Detroit.

THE Ed Levy Co. of Detroit has accepted two Allis-Chalmers HD-21 bulldozers for use in stockpiling slag. The new A-C crawlers are powered by 21000 A-C turbocharged diesel engines. Sale was made by Earle Equipment Co. of Detroit.

J. R. Panelli Equipment Co. of Southfield, Mich. has sold a Case model 1000 crawler with tilt-crown dozer to Warren Anderson of Fenton, Mich. The new Case is powered by a Continental JD 382 diesel engine.

A Northwest model 41 (30-ton) erection crane with a Caterpillar model 339 diesel engine was recently purchased by Darin-Armstrong Co. of Detroit. The new crane was purchased from Cyril J. Burke Inc. and will be broken in on a project near the Straits of Mackinaw.

WOLVERINE Tractor & Equipment Co. has sold a Hough H-90 powered by a Cummins diesel to Telegraph Supply Co. of Detroit.

TOLEDO Diesel Inc., dealer for Cummins Diesel Michigan Inc., recently installed a Cummins JN-6-BI (100 bhp at 2200 rpm) in a Michigan 175-A tractor-shovel for E. K. Bridge Construction Co. of Toledo.

GREAT Lakes Steel Corp. of Ecorse, Mich. has accepted delivery on two Allis-Chalmers HD-21 front end tractoloaders equipped with 4 yd. buckets. Sale was made by Earle Equipment Co.

DEPT. of Street Maintenance of the city of Detroit has accepted delivery of a Case model W-9A front end loader powered by a Case A301DA diesel. Sale by J. R. Panelli Equipment Co.

CYRIL J. Burke Inc. reports the sale of a model 41 Northwest (1 yd.) combination pullshovel clam & dragline. The unit was purchased by Charles J. Rogers Construction Co. of Detroit, and will be used on expressway work and other highway projects.

OTTOWA Equipment Co. of Tawas, Mich. has accepted delivery on an International TD 20 crawler with bulldozer blade. Sale was made by Wolverine Tractor and Equipment Co.

R. G. Moeller Co. has sold a Trojan model 204 tractor shovel to Thunder Bay Gravel Co. of Alpena, Mich. The new tractor has a 2 yd. bucket and is powered by a GM 3-71 diesel engine.

A Case model W-3 front end loader and backhoe combination was recently sold to Mole Construction Co. of Taylor, Mich. The new Case is powered by a D188 Case diesel, and was purchased from the J. R. Panelli Equipment Co.

THE city of Cheboygan, Mich. has accepted delivery on a Northwest 25D pullshovel, crane and dragline combination. The unit is powered by a GM 3-71 diesel engine, and was sold by Cyril J. Burke Inc.

WOLVERINE Tractor & Equipment Co. recently sold a Galion T-600 grader powered by a Cummins diesel engine to C. L. C. Trucking Co. of Clarkston, Mich.

R. L. Coolsaet Construction Co. of Dearborn, Mich. has accepted delivery on a John Deere model 440 tractor with front end loader and backhoe. The unit is powered by a GM 2-53 diesel and was purchased from the R. G. Moeller Co.

A Case model 800 crawler angle dozer was recently delivered to Diggerman Inc. of Wyandotte. The Case is powered by a Continental HD 277 diesel engine and was purchased from J. R. Panelli Equipment Co.

New Warehouse, Office

The Cooper-Bessemer Corp., Mount Vernon, Ohio is building a new warehouse and service office in Omaha, Neb. The new 3,000 sq. ft. structure is expected to be in operation by August 1. The building will cost $70,000. Upon completion, the new building will stock repair parts to service Cooper-Bessemer engines and compressors in the seven-state North Central sales district.

Florida Diesel News

By Ed Dennis

MIAMI Marine Engineers Inc. have been appointed dealers for the Cummins marine diesel engines for Dade, Collier and Monroe Counties.

SHIPPED on the *Inagua Cloud*, to Brown & Roote-Sud Americana in Columbia, S. A., four Euclid TS-14 tractor scrapers each powered by a pair of GM 4-71 diesel engines; one powers the tractor the other pushes the scrapers.

A Lister-Blackstone model SL2 rated 12 hp at 1800 rpm to power an 8 kw generator on the tug *Samual* owned by Belcher Towing Co. From Shelley Tractor Co., Miami.

THE *Tiki* of Panama City, a recently launched 67 ft. snapper boat owned by Capt. L. M. Anderson, has an OM-326 Mercedes-Benz six cylinder diesel engine rated 170 hp at 2000 rpm with Capitol 3.88:1 r&r gears for main power. The auxiliary is a 7½ hp Lister diesel.

SHIPPED to Minister of Works, St. Johns, Antigua, B.W.I. under the I. C. A., U. S. Overseas Mission, a trailer mounted Cedarapids portable crushing, screening and washing plant, powered by a GM 6-71, 175 hp diesel engine and power take-off, for training purposes in the islands.

SAW the newly installed model K.V. SS 12 Mirrless 12 cylinder 3096 hp turbocharged diesel with a Brush 2500 kva generator at the Borgue station of the Jamaica Public Service (B.W.I.).

NEAR New Port Richey, the Sumner-Sollitt Co. is using a GM model 3-71 diesel in a model 48 Little Giant crane and a similar model in a Mayhew dynamite drill rig to power the Gardner-Denver air compressor. These diesels are rated 67 cont. hp at 1800 rpm.

LEE Motors of Fort Myers supplied a model 330, 6 cylinder Ford diesel rated 96 hp at 2400 rpm for Harper Bros. to repower a Chevrolet truck. A similar model went to Howard Boyle of West Palm Beach.

AT Tampa, General Engine & Equipment supplied a GM 6-71E marine diesel engine with 2:1 r&r gears for a Pinellas County Park Dept. boat.

SEVEN trawlers for British Guiana shrimp fleet from Diesel Engine Sales, St. Augustine. Each of the 72 ft. Sahlman Seafoods trawlers is powered by a Caterpillar D342T diesel engine rated 220 hp at 1225 rpm.

FOR the Bahama Tractor Co., Nassau, a Caterpillar 944-A Traxcavator with a 105 hp turbocharged Cat diesel plus a Cat D311 series H mobile generating set, via West India Shipping Co.

TWO Allis Chalmers HD-11 (99 hp) and one HD-16 (125 drawbar hp) crawler tractors are now working for D. M. Pappy & Sons, Ocala, in a rock pit operation; from Richardson Tractor Co., Tampa.

GREAT Southern Trucking Co. is taking delivery of 77 White #5000 hiway tractors powered by Cummins NHE-195 diesel engines, with Fuller transmissions and Perry water filters. These 743 cu. in. displacement diesels are rated 195 hp at 1950 rpm.

THE 45 ft. fishing boat *Miss Virginia* of Tarpon Springs was repowered by a GM 4-53 marine diesel engine, 85 cont. hp at 2200 rpm and Borg-Warner 2.91:1 r&r gears.

UP near Myakk River State Park, Alonzo Cathron, is operating a pair of T-55 International Payscrapers (14 cu. yd.). These are powered with the Cummins HRB-600 diesels and are rated 172 hp at 1800 rpm from Florida Georgia Tractor Co.

BOUND in Blue, a Rybovich built sportsfisherman, was powered by a pair of D333 Caterpillar marine diesel engines. These aftercooled and turbocharged engines are rated 270 hp at 2200 rpm have Twin Disc 1.5:1 r&r gears. From Shelley Tractor & Equipment Co., Miami.

TO repower a rock crusher for Gulf Land Enterprise at Hudson, a GM 3-71 67 cont. hp at 1800 rpm with power take-off plus a 2031-C GM to repower a Bucyrus-Erie dragline for E. I. Rutledge at St. Petersburg from Jacksonville Br. Detroit Diesel Div. G. M.

AT Montego Bay, Jamaica, B.W.I., a model 660 Chicago Pneumatic rated 750 hp at 327 rpm with a 625 kva Electric Machinery generator and a similar installation being used at a substation outside the city.

THE 83 ft. *Aquanauts* repowered from 600 hp gasoline engines to a pair of General Motors 6-110 diesel engines with 3:1 r&r gears to drive 38 x 36 in. Columbia three blade propellers for a new speed of 16½ knots at 1950 rpm. Also installed a 20 kw generator powered by a 2-53 G. M. diesel; by Ellis Diesel Sales & Service of Fort Lauderdale. This vessel is used in the production of the TV series "Sea Hunt" and "Aquanauts".

GM Northwest Distributors

The Detroit Diesel Engine Division of General Motors has appointed Emerson GM Diesel, Inc. of Seattle, distributor for the Division's line of diesel engines in western Washington and a section of southern Alaska and the Pacific Diesel Power Co., as distributor for western Oregon and several counties in southern Washington. The Emerson company, a newly established firm, succeeds Modern Motors, Inc., a Division of Evans Engine and Equipment Co. The latter company continues as a Detroit Diesel distributor at Anchorage, Alaska and also as distributor for other General Motors products.

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VINTON LSV TEAM . . . (Left to right) L. I. Reid, Vinton Power Plant Superintendent, E. L. Faull, Cooper-Bessemer Service Engineer and R. B. Scott, C-B Sales Engineer. Behind them are the new LSV-16 gas-diesel engine and En-Tronic Control.

Vinton expands with fuel-saving LSV engine

Like many other progressive municipalities, Vinton, Iowa, faced up to expanding demand by increasing the output of its power plant. However, before making critical decisions, Vinton officials investigated thoroughly the performance records of equipment. They learned of the performance of Cooper-Bessemer LSV dual-fuel generator drives —how they perform in many other installations with fuel savings of up to 30%.

You see the result of this consideration in the photo here. Three key men in the expansion project are shown and identified just after they started the new Cooper-Bessemer 3520-hp, 16-cylinder supercharged engine. The 2500 kw installation also includes a Cooper-Bessemer En-Tronic System for complete control and protection of the new facilities.

We invite you to follow the example of Vinton. Examine the record. Learn how you can get the capacity you need and reduce costs, too. Call the nearest office for details on Cooper-Bessemer engines, compressors and En-Tronic Control.

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